AIRPHOTO INTERPRETATION OF ENGINEERING SOILS OF INTERSTATE HIGHWAY ROUTE 64 BETWEEN SCALESVILLE AND NEW ALBANY IN WARRICK, SPENCER, DUBOIS, PERRY, CRAWFORD, HARRISON AND FLOYD COUNTIES, INDIANA

SEPTEMBER 1965
NO. 24

by

P. T. YEH

Joint
Highway
Research
Project

PURDUE UNIVERSITY
LAFAYETTE INDIANA

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Progress Report

AIRPHOTO INTERPRETATION OF ENGINEERING SOILS INTERSTATE ROUTE I-64: BETWEEN SCALESVILLE AND NEW ALBANY IN WARRICK, SPENCER, DUBOIS, PERRY, CRAWFORD, HARRISON AND FLOYD COUNTIES, INDIANA

To: G. A. Leonards, Director
Joint Highway Research Project

September 24, 1965

From: H. L Michael, Associate Director
Joint Highway Research Project

File: 1-5-5
Project: C-36-51E

The attached report entitled "Airphoto Interpretation of Engineering Soils of Interstate Route I-64 between Scalesville and New Albany in Warrick, Spencer, Dubois, Perry, Crawford, Harrison and Floyd Counties, Indiana," completes the project concerned with engineering soils mapping of the Interstate system from aerial photographs This project was prepared as a part of an investigation conducted by Joint Highway Research Project in cooperation with the Indiana State Highway Commission, the Bureau of Public Roads and the Soil Conservation Service. The report was prepared by P. T. Yeh Research Engineer, Joint Highway Research Project

The soil mapping of I-64 between Scalesville and New Albany was done entirely by airphoto interpretation technique To increase the value, the soil strip map was prepared on a photographic base with annotation to show soil areas The generalized soil profiles were prepared from the available literature.

Respectfully submitted,

H. L. Michael, Secretary

HLM:bc

Attachment

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Progress Report

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Project: C-36-51E
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AIRPHOTO INTERPRETATION OF ENGINEERING SOILS
INTERSTATE ROUTE 1-64 BETWEEN SCALESVILLE AND NEW ALBANY IN WARRICK, SPENCER, DUBOIS, CRAWFORD, HARRISON AND FLOYD COUNTIES, INDIANA

INTRODUCTION

This report and series of aerial photographic strip maps represents the airphoto interpretation of engineering soils for the section of Interstate 64 from Scalesville east to New Albany. The section includes parts of Warrick, Spencer, Dubois, Perry, Crawford, Harrison and Floyd Counties, Indiana. The aerial photographic strip map extends about one and one half mile on each side of the center line along the proposed route.

Unrectified aerial photographs of a scale of 1/24,000 taken in April and May of 1958 by the Photronix, Inc. of Ohio were used in this study. The reader should be aware of the fact that many cultural or surface features in the area have changed since the aerial photography was obtained. This is especially true in the strip mining area near Scalesville in Warrick County.

The photographic strip map is presented in a mosaic at an approximate scale of one inch representing 1,5000 feet (1/18,000). Since unrectified aerial photographs were used, the aerial mosaic may not match perfectly from one to the other.

The engineering soil maps were prepared by airphoto interpretation methods. The procedures used were similar to those employed in county mapping projects previously completed by the staff of the Joint Highway Research Project (1)*. No field checks and no soil explorations were made. However, available literature concerning this area was searched and used to complement the interpretation.

Reference was made to the agricultural soil surveys for Floyd and Harrison Counties (2) (3) and four airphoto interpretation theses (4, 5, 6 and 7).

DESCRIPTION OF AREA

General. The area of interest along I-64 starts at Scalesville of Warrick County, Indiana and extends in an easterly direction toward New Albany about 75 miles to the east. The route traverses entirely within the driftless zone of Indiana. It crosses many physiographic provinces and the most rugged county of Indiana.

Physiography. The entire section of this survey is situated in the aggraded valley section of the Interior Low Plateau Province of the United States (8). It is a low, maturely dissected, plateau of sedimentary rock with extensive loess cover and wide alluvial filled valleys.

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* Figures in parentheses refer to references appearing in the bibliography

Locally, the route crosses from west to east five different physiographic divisions of Indiana, namely: Wabash Lowland, Crawford Upland, Mitchell Plain, Norman Upland and Scottsburg Lowland (8). The western third of the study area is located in the Wabash Lowland division. The section from Perry County to the western part of Harrison County is on the Crawford Upland. The limestone area in Harrison and Floyd Counties belongs to the Mitchell Plain division. A narrow strip from Edwardsville to New Albany in Floyd County is classified as Norman Upland. New Albany, at the eastern end is situated on the Scottsburg Lowland.

Topography. Since the proposed route traverses many physiographic divisions, the topography of the study area varies greatly from one section to the other. At the western part of the strip wide and nearly level valleys and lakebeds and rolling hills constitutes the landscape. The elevation of the lacustrine plains leading to the Ohio River is between 410 to 430 feet above sea level (9). Local relief is seldom greater than 80 feet (9).

Near the western border of Perry County, the topography changes into a rugged dissected land. Irregelarly shaped ridges are about 180 feet above the trench-like flat-bottom valleys or lakebeds below. The altitude of the ridges gradually increases toward the east, from about 650 feet near the northeastern corner of Spencer County to about 880 feet near White Cloud in Harrison County. Local relief also increases to about 400 feet magnitude along Blue River south of Wyandotte Cave at the southeastern corner of Crawford County. In the western part of the Crawford Upland the ridges are very narrow and extremely irregular in shape.

However, the section between Little Blue River and Blue River in Crawford County has broad and undulating divides. Some sinkholes and shallow depressions are scattered within these divides.

After passing White Cloud to the south the route descends onto the Mitchell Plain. The western portion of the Mitchell Plain is characterized by sinkhole topography. Except for a few high hill or ridge remnants of the Chester Formation which forms the Crawford Upland, the local relief of this rolling sinkhole plain generally is about 50 feet.

The sinkhole topography dissappears toward the east starting at a point about two miles east of Indian Creek. This portion of the plain exhibits only a few sinkholes. The topography is very gently rolling. Maximum local relief of up to 150 feet may be found along the main drainage channels. The general elevations of the Mitchell Plain is about 600 feet at its western border. The elevation increases toward the east and attains an altitude of 978 feet near its eastern limit about one mile south of Duncan (9).

Between Edwardsville and New Albany the route should descend about 450 feet in about three miles along the face of the Knobstone escarpment. Ridges are knife shaped in this deeply dissected area. The greatest local relief of Indiana occurs here.

New Albany, where the route terminates in this study, is located on an Ohio river terrace in the Scottsburg Lowland. The elevation of the terrace varies from 450 to 470 feet. The Scottsburg Lowland to the north has a gently undulating topography with an elevation of aboet 500 feet and gradually increases toward the north.

Geology. The study strip lies in three different geological systems, namely: Pennsylvanian, Mississippian and Devonian (8). The bedrock formations are irregular and complex.

The western portion of the strip lies in the region of the coal measures of Pennsylvanian Age. The formations occur in thick alternating beds of shale and sandstone with intermingling strata of thin limestone, coal and/or clay. Underlying the coal measure is the Mansfield formation. It is typically a coarse grained, sometimes cross-bedded, massive sandstone. The outcrop of this thick and resistant Mansfield sandstone occurs near the western border of Perry County. This formation frequently caps hills. However, some remnants of the coal measures formation may be found on top.

The Chester Series of Mississippian Age lies below the Mansfield sandstone formation. It comprises the greater part of the Crawford Upland area. The series consist of alternating sandstone, shale and limestone with a total thickness of more than 400 feet in Perry County.(8). There are about 20 recognized formations in the Chester series ranging from 3 to 55 feet (10). The generalized stratigraphic column of the series is listed as follows (10):

Upper Chesterian	Kinkaid limestone formation	25 feet
	Degonia sandstone formation	15 feet
	Clore limestone formation	25 feet
	Palestine sandstone formation	10 feet
	Menard limestone formation	55 feet
	Waltersburg sandstone formation	7 feet
	Vienna limestone formation	50 feet
	Tar Spring sandstone formation	40 feet
Middle Chesterian	Glen Dean limestone formation	55 feet
	Hardinsburg sandstone formation	30 feet
	Golconda limestone and shale formation	45 feet
	Cypress sandstone formation	30 feet
Lower Chesterian	Beech Creek limestone formation	15 feet
	Elwren sandstone formation	38 feet
	Reelsville limestone formation	3 feet
	Sample sandstone formation	30 feet
	Beaver Bend limestone formation	15 feet
	Mooretown Sandstone formation	22 feet
	Paoli limestone formation	25 feet
	Aux Vases sandstone formation	5 feet

Shale deposits are numerous within the Chesterian series. They occur as thin layers or lenses interbedded in the formation, especially between formations. Therefore, along the bluff of the upland or the valley walls many formations are encountered.

Outcrops to the east of the Crawford Upland belong to the Mitchell limestone formation of the Meramecian series of Mississippian Age. This is a group of limestones totaling some 320 feet that are exposed on the Mitchell Plain. The upper layers belong to the Ste. Genevieve limestone (about 120 feet in thickness). About 200 feet of St. Louis limestone follows immediately (10). The Mitchell limestone though comprised of several geologic units is a great lithologic unit of compact, thinly bedded, highly jointed limestone layers with occasional thin bands of shale and impure limestone. In places the limestone contains considerable amounts of chert (8). In the eastern part of the Crawford Upland practically all of the streams have cut down into the Mitchell limestone formations. Indian Creek and Blue River are intrenched 150 to 200 feet in the formations.

Exposure of some 65 feet of Salem limestone is found in the eastern portion of the Mitchell Plain (11). This is a mdeium to coarse-grained limestone whose individual grains are composed of micro fossils (12).

The bottom formation of the Meramecian Series is the Harrodsburg limestone. It varies from 60 to 80 feet in thickness outcroping along the eastern portion of the Mitchell Plain. It is a medium fragmental to coarsely fragmental crinoidal limestone containing chert and geodes.

Along the Knobstone escarpment between Edwardsville and New Albany the Borden Group of the Osagian Series of the early Mississippian and/or later Devonian Age outcrops. The Borden Group is about 500 feet in thickness in the study area (12). The group can be subdivided into five formations. Clay and shales are predominant at the bottom of the group and fine-grained rather massive impure sandstone or siltstone prevail at the top. Thin ledges of relatively pure sandstone, rarely more than one foot in thickness, are present throughout the middle and the upper part of the group (8).

The city of New Albany is situated on the New Albany shale formation of the late Devonian Age. The black shale (or slate) outcrop along the Ohio River bank is about 110 feet in thickness (13).

The complex exposure of rock formations from Edwardsville to New Albany along SR 62 was recorded by L. W. Borden as follows (14):

1.	Soil and/or rock	40 feet
2.	Gray limestone used for making roads and paving streets	30 feet
3.	Imperfect stratified crystalling gray limestone containing fossiles	25 feet
4.	Massive Knob sandstone with nodule of iron stone	125 feet
5.	Stratified sandstone and shale	220 feet
6.	New Providence shale and iron stone	126 feet
7.	Greenish limestone	2 to 3 feet
8.	The thickness of the New Albany black shale at New Albany	104 feet

The bedrock surface has been modified by erosion and, in general, has been modified by, fluvial and eolian processes. Lacustrine plains, wide alluvial plains and terraces along rivers and streams are formed by fluvial processes. The area north of New Albany has been subjected to glaciation and the Illionian deposits overly the bedrock surface.

Climate. The strip is situated in a continental climate belt, with hot summers and moderately cold winters. The absolute temperature in this study area varies from $-22^{\circ}F$ to $111^{\circ}F$ (15). The extremes of temperatures, however, are usually of short duration. The average annual precipitation ranges from 42 to 46 inches (15).

LAND FORMS AND ENGINEERING SOIL AREAS

Engineering soils of this area chiefly are derived from different types of bedrock. However, the surface soils are significantly influenced by a thin mantle of loess. The upper horizons of the soil profiles, therefore, are silty in texture throughout the entire area. Subsurface soils and the parent materials are different from one deposit or formation to the other. Variation in the soil profile is expected as the topography changes.

A total of eighteen soil areas have been differentiated and numbered for the route of I-64 described herein including the portion of the route immediately to the west of this section. The western portion is described in Joint Highway Research Project Report No. 4 by P. T. Yeh (16). The western portion of I-64 contains seven soil areas. For simplicity of explanation and for easier correlation with the route to the west of this section, all seven soil areas will be appended to this report, although only four areas are applicable in this study. Fifteen soil areas actually appear on the annotated mosaic attached to this report.

The discussion that follows is a brief description of each soil area portrayed on the aerial photographic strip maps including the soil areas previously reported along I-64 from U. S. 41 to Scalesville (15).

1. Moderatley Deep Loess Deposits

This type of soil does not appear on the route described in this report.

2. Thin Loess on Shale - Sandstone Residual Soil

This soil area occurs between Scalesville and Ferdinand. The soil area is designated as No. 2 and the soil profile is shown as profile No. 2. The soil areas closely associated with the broad alluvial plain and lacustrine plains. Except areas in the vicinity of Ferdinand most of the soil areas are below 480 feet in altitude. The topography is gently rolling. Surface drainage of the area is fairly well developed. The depth of the loess mantle is generally less than three to six feet and may be absent in places where severe erosion has occurred. The development of the soil may, therefore, be influenced by the bedrock material.

The surface soil as shown in profile No. 2 varies from a friable silt loam to a silty clay loam. The inferred classification of the surface soil is an A-4 or A-6. The subsurface soil varies between a silty clay loam to a more plastic silty clay. A clay loam layer with broken and weathered rock fragments is frequently found at depths of three to six feet on top of the interbedded sandstone and shale.

The problem in this area is the variation of loess to rock in shallow cut areas and the placement of fill on loess material.

3. Residual Shale-Sandstone Soil

The residual shale-sandstone soil is indicated on the map as area No. 3. Although it is called residual soil in this study, the area is covered with a very thin loess mantle. The mantle varies from a depth of less than 18 inches to as much as 30 inches. On the steeper slopes where soil is subjected to severe erosion the loess mantle may have been completely removed.

The Shale-sandstone soil region is concentrated on the western part of the strip, especially in Warrick and Spencer Counties. It disappears completely before reaching the border of Crawford County. Hilly topography predominates in this region and the deposit sometimes appears as isolated hills or ridges.

Underlying the silty top soil the subsoil, derived from the shale-sandstone bedrock, is predominantly silty clay. It is inferred that these soils would be classified as A-6 or A-7 subgrade material. A loam soil which tends to be more sandy with depth and contains many rock fragments, is found overlying the interbedded shale-sandstone formation. The thickness of this loam varies according to topographic position.

The engineering problems in this soil region are generally associated with alignment and rock cuts. Pumping and subgrade failures may be a problem in cuts where seepage occurs because of interbedded sandstone and shale. Since tremendous coal strip mining operation occurs near Scalesville, the vast torn-up land of mixed debris should be given special attention.

4. Lacustrine Soil

The proposed route crosses a number of lacustrine plains in the western portion of the strip. The width of the plains varies from 2000 to 4000 feet along the route. The elevations of the lacustrine deposits is less than 430 feet, except the one in the East Fork White River basin where Hunley Creek is situated about two or three miles west of Ferdinand. The surface materials on these lacustrine plains may be of alluvial origin and associated with the streams that meander across them.

The topography of the lacustrine plain is nearly level. Slight depressions, however, are found and some of these may be abandoned meander scars of the stream. In these depressions accumulation of organic material and high water table may occur.

Soils of the lacustrine plains are fine textured deposits of silt or silty clays (A-4 to A-6) as indicated in soil profile No. 4. The surface is a silty clay loam and the subsurface soil varies from silty clay loam to silty clay. The texture becomes more clayey with depth. Stratified layers including silts and/or sands with clays may be found at depth. Organic material may be found in the depressions.

The engineering problems in this area consist of providing drainage and adequate subgrade support. Settlement of high fills placed on the lacustrine materials should be considered. Flooding may be a problem also.

5. Alluvial Soil

The proposed route crosses many alluvial valleys. The longest section, about 9000 feet in length, is located along the flood plain of Anderson River near Kitterman Corner in Perry County. The alluvial valleys are flat bottomed and the gradient is very gentle. These aggraded valleys are being filled with silty deposits from the surrounding uplands. The distinction or delineation between lacustrine plain and flood plain is difficult because they frequently merge.

Extremely silty soils are found in the alluvial deposits as illustrated in soil profile No. 5. Both the top soil and the subsoil are friable silt loam (A-4 in general) except that the top soil is darker in color due to higher organic content. A heavier silt loam or silty clay loam may be encountered at depth. In the slightly depressed area silty clay loam soil are predominant throughout the profile. Lenses of sand and distinct stratification of silt and clay may be found.

Since these soils are subject to flooding, subgrade support is poor during wet seasons. Problems of settlement as in the lacustrine plains may occur.

6. Colluvial Soil

This type of soil does not appear on the route described in this report.

7. Terrace Soil

This type of soil does not appear on the route described in this report.

8. Residual Sandstone-Shale-Limestone Soil

The residual Sandstone-Shale-Limestone soil is developed from the Mansfield sandstone formation and the Chester series. This soil occurs in the Crawford Upland in Perry, Crawford and the western part of Harrison Counties. In Perry County the massive Mansfield sandstone

caps most of the ridges and is gradually given way to the other formations toward the east. Because the bedrocks are composed of a great number of non-resistant shales, and resistant sandstone with many intercalated beds of limestone, rugged topography results. Sinkholes and shallow depressions may be found in sandstones overlying limestone. Outliers, cuestas, and canyon like gorges etc. are some of the landscape features.

The soils present in this area are almost completely sandstone soils. Insignificant amounts of limestone and shale soil mantle occurs in spots. The soil profile is shown as No. 8. It illustrates the influence of the thin loess cover in the upper horizons. The surface soil is a silt loam (A-4) and the subsurface soil is a silt clay (A-6 to A-7) with increasing plasticity with depth. Rock fragments increase toward the bedrock surface and the soil texture changes to a clay loam. On the steep slopes where erosion is severe stony fragments may be found on the ground surface. Limestone and shale fragments are found on the milder sideslopes of the area in a colluvial form.

The major engineering problem in this area is the amount of cut and fill. In the area of shale weak supporting power is expected. Slide, sloughing and subsidence may be anticipated. However, in the eastern part near Harrison County where the Chester series thins and the Mitchess limestone formation outcrops field investigation is important to discover the underground caves and cavities formed in the underlying Ste. Genevieve limestone. Wyandotte Cave is the largest (13).

9. Residual Sandstone over Limestone and Shale Soil

This soil is developed on the Hardinsburg sandstone formation of the Chesterian series. It occurs between Little Blue River and Blue River in Crawford and Harrison Counties respectively. The formation acts as a capping stone of the wide divides which have considerable width (at places measured more than one mile across). The surface is flat to undulating. Some monadnock-like masses on these divides are remnants of the upper formations. A few sinkholes are scattered on the surface. This is the result of the collaps of the sandstone on the sinkhole formed in the limestone beneath. This Hardinsburg sandstone formation is about 30 feet in thickness and is composed of thin, flaggy sandstone layers frequently separated by thin bands of shale (8). As a unit, it is remarkably resistant to erosion.

Soil profile No. 9 shows that the surface soil varies from silt loam to a silty clay loam (A-4). Plasticity increases in the subsurface soil and a clay loam (A-4) soil is found on top of the hard sandstone.

The engineering problem is to avoid the collapse sinkholes if possible or bridge across them.

10. Residual Limestone/Sandstone Soil

This soil area associates closely with the Hardinsburg formations as mentioned previously. All of the bedrocks, except the area west of Little Blue Creek, are limestones of the Glen Dean formation. They are remnants of Glen Dean formation and are shaped like monadnock on the flat and resistant Hardinsburg sandstone formation. Many sinkholes are formed on this formation. West of Little Blue Creek, where Sulphur is situated, the ridge is about 100 feet above the Hardinsburg formation. It belongs to the Vienna limestone formation and is underlain by the Tar Spring sandstone formation (10).

The surface soil of this area varies from silt loam to a silty clay loam (A-4) as shown in profile No. 10. Silt clay or clay soil is found in the upper B horizon. The lower part of the B horizon is a very plastic clay (A-7) developed from the limestone bedrock below.

Sinkholes are the major problem in this area.

11. Residual Limestone Soil

This soil area occurs in the western portion of the Mitchell Plain in Harrison County. The regional landform is that of a plain sloping gently to the southwest. Locally the topography is rolling and everywhere broken by innumerable sinkholes of variable size.

The soil is developed in the outcrop area of the thin bedded and jointed Ste. Genevieve and St. Louis limestone. The limestone formations contain some chert. Soil profile No. 11 shows that the surface soil is a silt loam or a silty clay loam (A-4) underlain by silty clay or clay. These layers are likely derived from the loess. Red color plastic clay (A-7) with some chert framents is found in the subsoil on the limestone bedrock.

Subgrade support is a problem in the plastic limestone soil. Sinkholes are the other important problem. Cap and seal methods can be used for the small sinkholes. However, bridging may be required for the larger ones.

12. Limestone Rock Terrace Soil

Along Indian Creek in Harrison County a number of flat-top terraces are recognized. The terraces are slightly higher (about 20 feet) than the flood plain but much lower than the upland adjoining. Some sinkholes may be developed on the terrace or bench surfaces.

The rock terrace soil is about the same as the limestone soil as mentioned in profile No. 11. The only difference might be the surface silt which is partly deposited by fluvial process and the sinkholes are not well developed as in the upland. Because of the shallowness of the sinkholes, they are less difficult to cap.

13. Alluvial Soil in Limestone Area

Very little surface drainage development shows on the western part of the Mitchell Plain. However, on the eastern part a considerable number of surface streams have developed. The streams have flat-bottomed flood plains gently sloping downstream.

The alluvial soils developed on the floor plain in the limestone region is shown in profile No. 13. The surface and subsurface soils in this area are a silt loam (A-4). A silty clay loam C-horizon is encountered above the limestone bedrock.

The engineering problems are about the same as on the alluvial soil mentioned in area No. 5.

14. Residual Cherty Limestone Soil

This soil occurs in the eastern portion of the Mitchell Plain. The soil is different from that on the sinkhole plain. It is thicker and contains a large amount of chert fragments. This is due to the higher proportion of impurities in the lower portion of the St. Louis limestone, the Salem limestone and the Harrodsburg limestone. Thin shale beds and nodular chert are common in these formations. The Harrodsburg limestone also contains numerous geodes.

The surface of the region is undulating and surface drainage systems are fairly well developed. Sinkholes, however, are greatly reduced in number in the west and completely dissappear along the eastern limit.

The soil is relatively deep and seldom less than 10 feet. As shown in profile No. 14 it has a silt loam to a silty clay loam top soil (A-4), followed by more plastic silty clay or clay (A-6, to A-7) with some chert fragments. The layer directly over the cherty limestone bedrock is a very plastic clay (A-7) with a large number of chert fragments. Geodes are mixed in the soil profile near its eastern limit.

Sinkhole problems are greatly reduced in this area but problems arise from the topography and the interbedded shales.

15. Residual Sandstone-Shale Soil

In the Knobstone escarpment between Edwardsville and New Albany the soil is developed in the Borden Group. It is a complex series composed of sandstone, siltstone and shale with interbedded limestone. Edwardsville formation, the upper member of the group, consists of interbedded argillaceous sandstone siltstone and shale which contains many geodes in the upper portion. The lower part of the Borden Group is the New Providence shale.

The general soil profile is shown in profile No. 15. The surface soil varies from a stony sandy loam to a stony silt loam (A-2 to A-4). The subsoil has the same texture but increases with stonyness. Interbedded sandstone, siltstone and shale is found one to three feet from the surface.

The engineering problems are associated with the cut and fill in different types of bedrock and selection of proper grades for safety.

16. Residual Shale Soil

Along the Knobstone escarpment north of Middle Creek and west of New Albany there are benches about 250 feet below the top of the escarpment and about 200 feet above New Albany. The bedrock outcrops show mostly shale with thinly interbedded sandstone.

The soil profile as shown in profile No. 16 indicates that the surface soil has a silt loam (A-4) or silty clay loam (A-6) texture and followed by a silty clay or clayey (A-7) subsurface soil. Plastic clay is found in the lower portion of the soil profile before the shale bedrock is reached.

The engineering problems in this area are generally associated with drainage and subgrade support problems.

17. Illinoian Drift on Shale Bedrock Soil

North of New Albany and east of the New Albany escarpment there lies a low, flat, gently undulating region with an elevation of about 500 feet above sea level. This is the area of Illinoian drift overlying the New Albany Shale or Borden Shale near the foot of the escarpment where low benches appear.

The soil profile No. 17 shows that a silt loam (A-4) texture surface soil is followed by a silt clay (A-6) or clay (A-7) subsurface soil. The plasticity as well as the fragment content of shale increases with depth. The shale is found generally at a depth from four to eight feet from the surface.

Poor subgrade support is a problem. Shallow cuts generally encounter the underlying shale which subsequently weathers to produce a plastic clay. The shale is thinly bedded with layers only fractions of inches thick.

18. Terrace Soil

Along the Ohio River near the eastern end of the strip map there is a broad river terrace. The terrace, where the city of New Albany is located, has been dissected by stream alluvial plains into many terraces. The terraces vary from 450 to 470 feet in elevation and are 20 to 40 feet above the adjacent flood plains or 70 to 90 feet above the Ohio River.

The deposits in the Ohio River Terraces are composed of sand, silt and some gravels. The surface soil as shown in profile No. 18 varies from a silt loam to a silty clay loam (A-4). The subsurface soil is silty clay to clay in texture (A-6). A fine sandy loam is encountered before reaching the stratified sands, silts and gravel terrace deposit. By far, sand is predominant in these terrace deposits and the sandy deposits have been reworked by wind in some cases to form dunes on the surface of the terrace.

SUMMARY

The proposed route starts at Scalesville in Warrick County. Strip mines are on both sides in this dissected shale-sandstone area (Area 3). After crossing a wide alluvial plain (Area 5) about one and one half miles from Scalesville, the route traverses on a more subdued shale-sandstone region covered by thin loess (Area 2). It crosses the flood plain of Coles Creek and then proceeds across the shale-sandstone areas some of which show thin loess cover.

About one mile east of Selvin the route comes to a wide lacustrine plain along Little Red Creek and encounters another on Pokeberry Creek about one-half mile to the east. Between Pokeberry Creek and North Fork in Spencer County the route lies continuously on the undulating loess covered plain (Area 2) except at the crossing of the lacustrine plains of North Fork near the border of Warrick and Spencer Counties.

From North Fork to Hunley Creek the route is exclusively on the shale-sandstone region and it crosses the lacustrine plain of Hunley Creek (the broadest one in this study). In the vicinity of Ferdinand the route encounters thin loess covered area (Area 2) again with a few alluvial plains (Area 5).

The proposed route reaches the interbedded sandstone-shale-limestone area (Area 8) after crossing Ferdinand Run near the junction of Spencer, Dubois and Perry Counties. The Mansfield sandstone is found at the western part of Perry County. A wide lacustrine plain on Hurricane Creek and a huge flood plain on Anderson River are encountered. Many shale-sandstone remnants or ridges are scattered within this sandstone-shale-limestone region.

In the western portion of Crawford County along Stinking Fork near West Fork the sandstone-shale-limestone area occurs in two different levels. Dotted lines are used on the strip maps to indicate the low topographic position which is more than one hundred feet below the adjacent areas.

Near Sulphur the route lies on a flat-topped ridge. This is limestone soil (Area 10) on top of limestone and sandstone. After crossing Little Blue River the route encounters many broad flat-topped plaine or divides. They are the resistant Hardinsburg sandstone soil area (Area 9). Amidst of the Hardinsburg sandstone plain the proposed route crosses many limestone remnants (Area 10).

After passing White Cloud to the south and crossing Blue River the proposed route enters the sinkhole limestone soil region (Area 11). Limestone terraces (Area 12) and alluvial plain (Area 13) of Indian Creek are crossed by the proposed route. Two miles east of Indian

Creek the route enters a limestone plain with little or no sinkhole development (Area 14). The route crosses only a few small alluvial plains before it reaches Edwardsville.

From Edwardsville to the east the route traverses down the Knobstone escarpment (Area 15). It may encounter shale areas (Area 16), Illinoian drift over shale area (Area 17) and finally reach New Albany on the river terrace (Area 18).

The major problem of the study area seems to be the huge amount of cut and fill in the residual soil region. Except the limestone area, suitable material for road construction is a problem.

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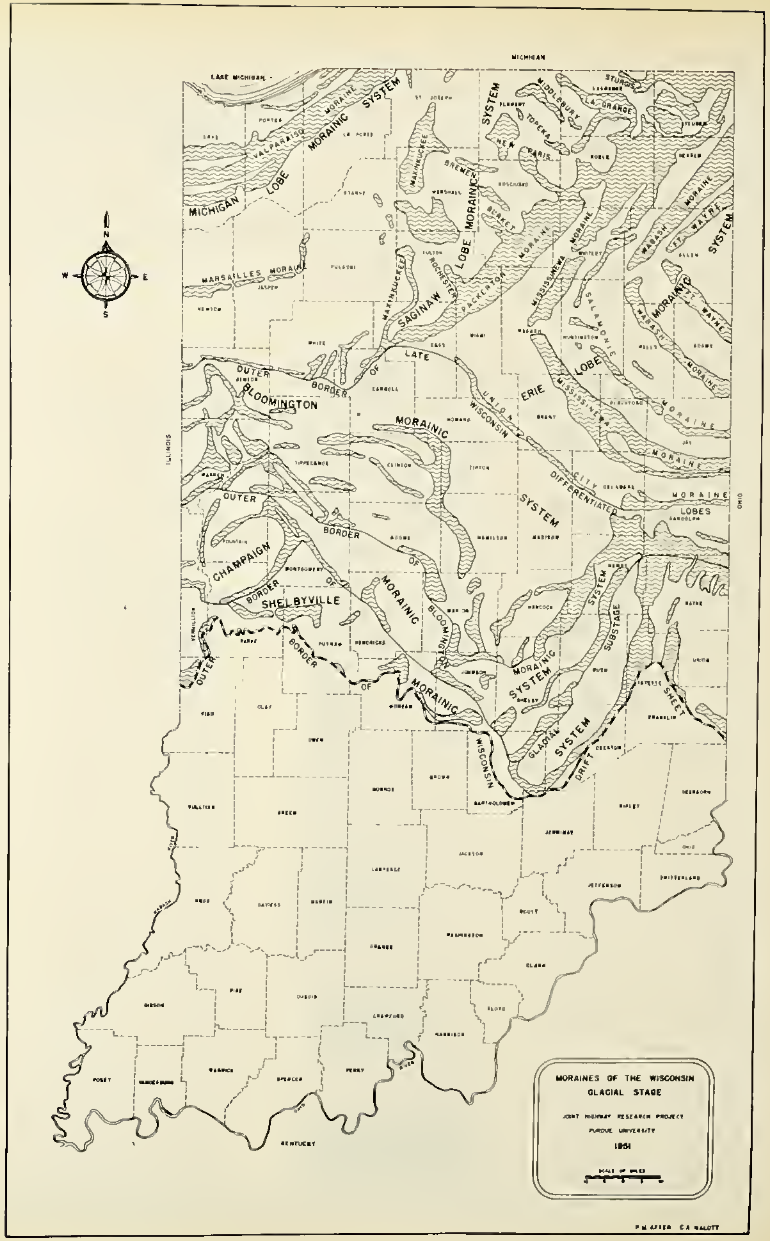
SOIL CLASSIFICATION AND PROFILE SYMBOLS

Description	Grain Size Distribution				Plastic Index	Symbol
	Gravel % Retained on #10	Sand #10–#200	Silt 0.05–0.005mm	Clay Less than 0.005mm		
Gravel	85–100	0–15	0–10	0–10	NP	○
Sandy Gravel	50–85	15–50	0–10	0–10	6 Max.	⁘
Sand	0–15	85–100	0–10	0–10	NP	⁚
Gravelly Sand	20–49	45–85	0–10	0–10	6 Max.	⁙
Sandy Loam	0–19	50–80	0–50	0–20	6 Max.	▨
Sandy Clay Loam	0–19	50–80	0–30	20–30	10 Max.	▩
Sandy Clay	0–19	55–70	0–15	30–45	11 Min.	▤
Loam	0–19	30–50	30–50	0–20	10 Max.	▨
Silt Loam	0–19	0–50	50–100	0–20	10 Max.	▨
Silty Clay Loam	0–19	0–30	70–100	20–30	11 Min.	▩
Silty Clay	0–19	0–15	55–70	30–45	11 Min.	▦
Clay Loam	0–19	20–50	50–80	20–30	11 Min.	▨
Clay	0–19	0–55	0–55	30–100	11 Min.	▤
Peat or Muck						■
Limestone						▦
Sandstone						▦
Shale						■
Stony Fragments						⬭
Organic Matter						▭
Topsoil						▥

Classification of Gravelly Soils

85%–100% gravel plus finer material – Gravel
50%–84% gravel plus finer material – Clayey, silty or sandy gravel
20%–49% gravel plus finer material – Use fine classification and called gravelly sand, gravelly silt or gravelly clay
0%–19% gravel plus finer material – Use fine classification only



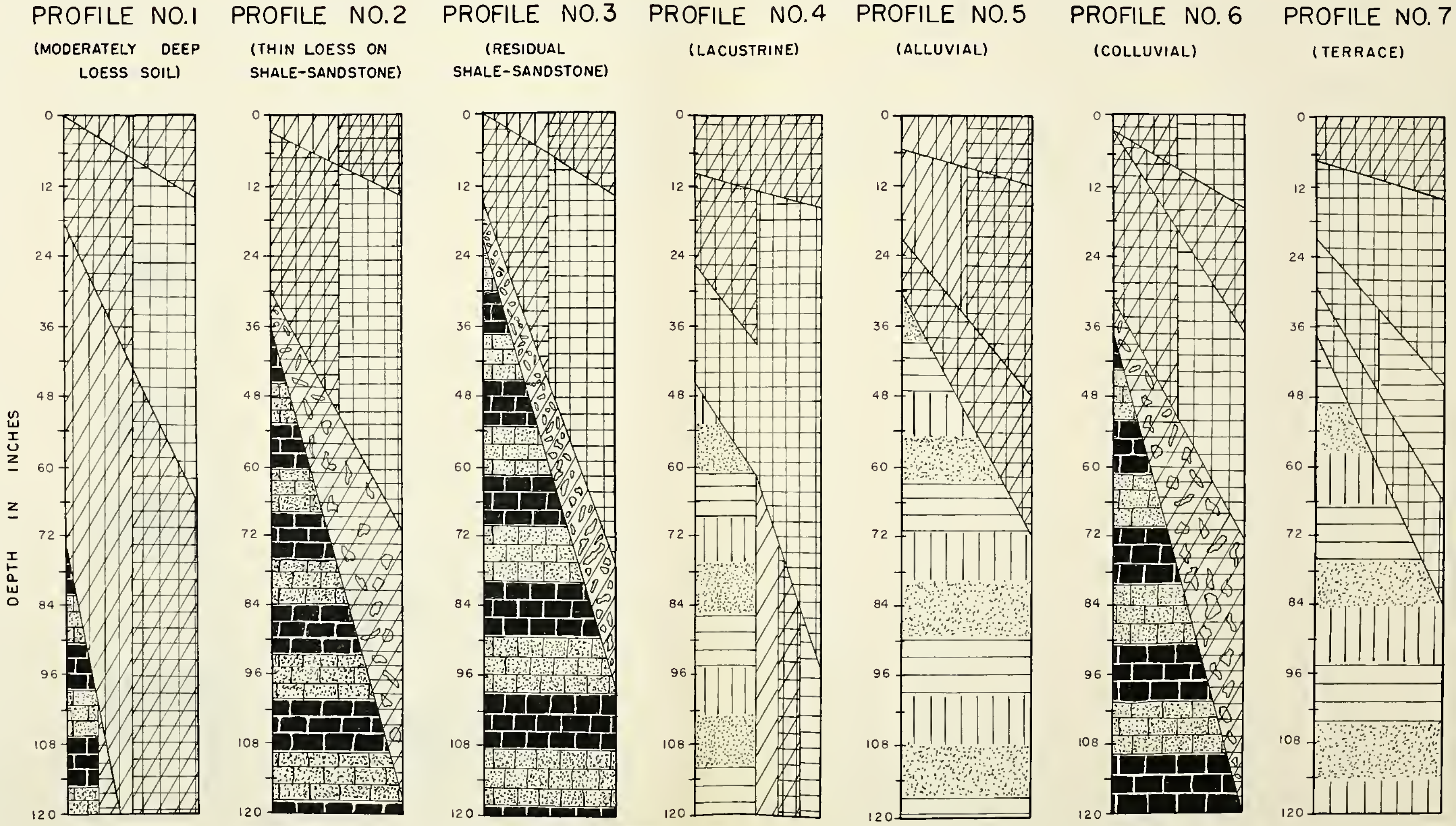
MORAINES OF THE WISCONSIN GLACIAL STAGE

JOINT HIGHWAY RESEARCH PROJECT
PURDUE UNIVERSITY
1951

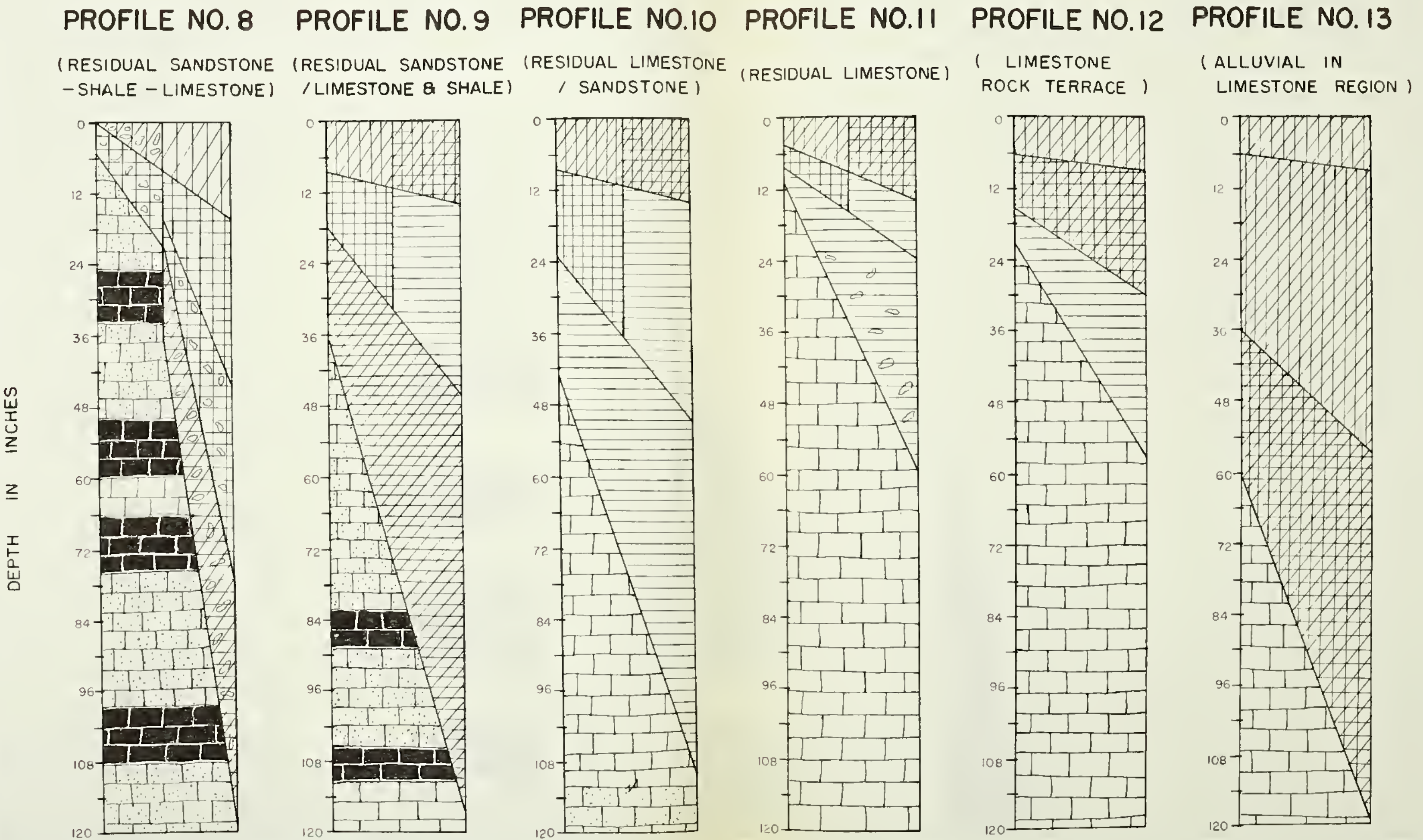
SCALE OF MILES

P.M. AFTER C.A. MALOTT

GENERAL SOIL PROFILES



GENERAL SOIL PROFILES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(RESIDUAL SANDSTONE - SHALE - LIMESTONE)
PROFILE NO. 9
(RESIDUAL SANDSTONE / LIMESTONE & SHALE)
PROFILE NO. 10
(RESIDUAL LIMESTONE / SANDSTONE)
PROFILE NO. 11
(RESIDUAL LIMESTONE)
PROFILE NO. 12
(LIMESTONE ROCK TERRACE)
PROFILE NO. 13
(ALLUVIAL IN LIMESTONE REGION)
DEPTH IN INCHES
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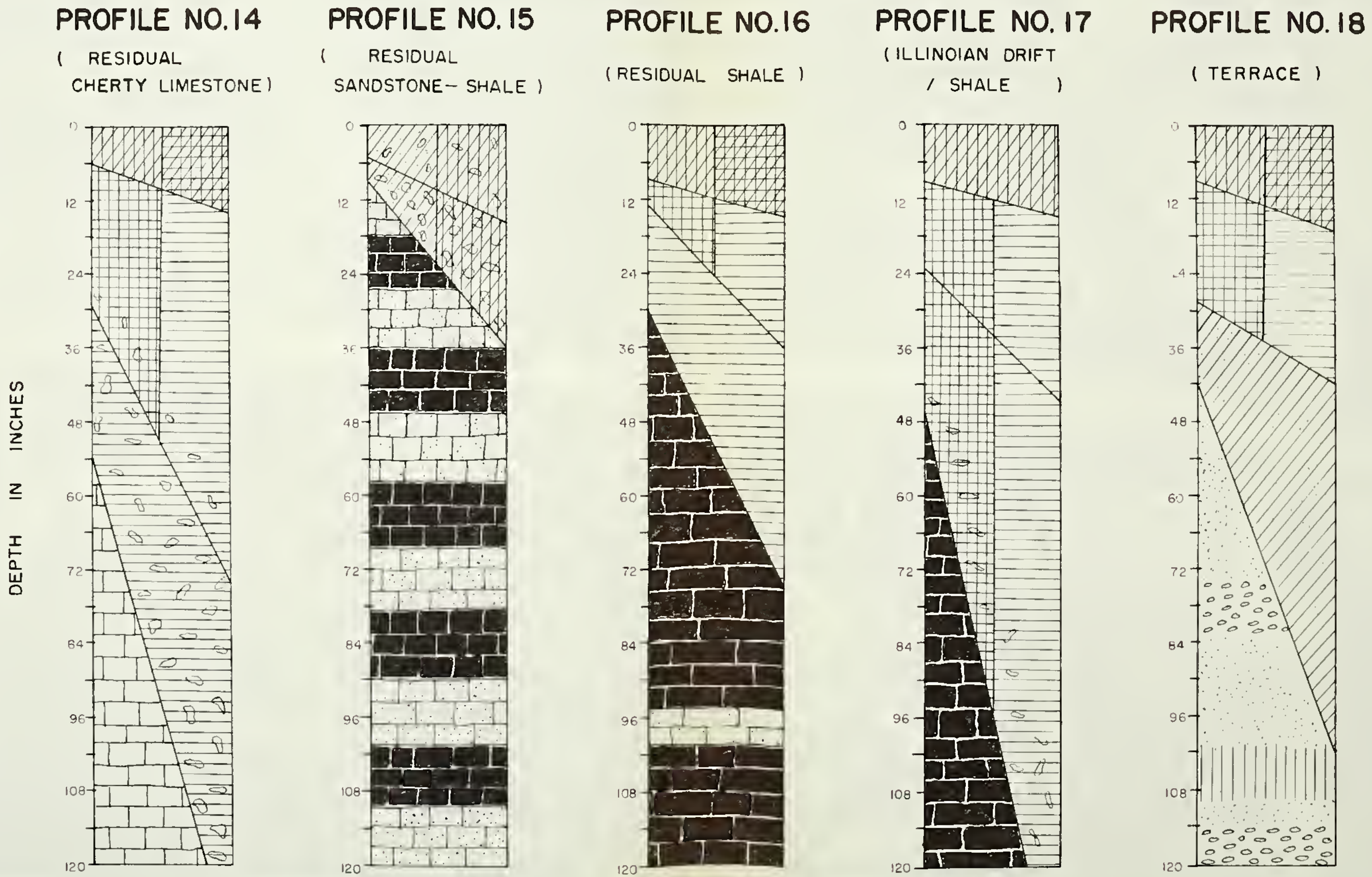
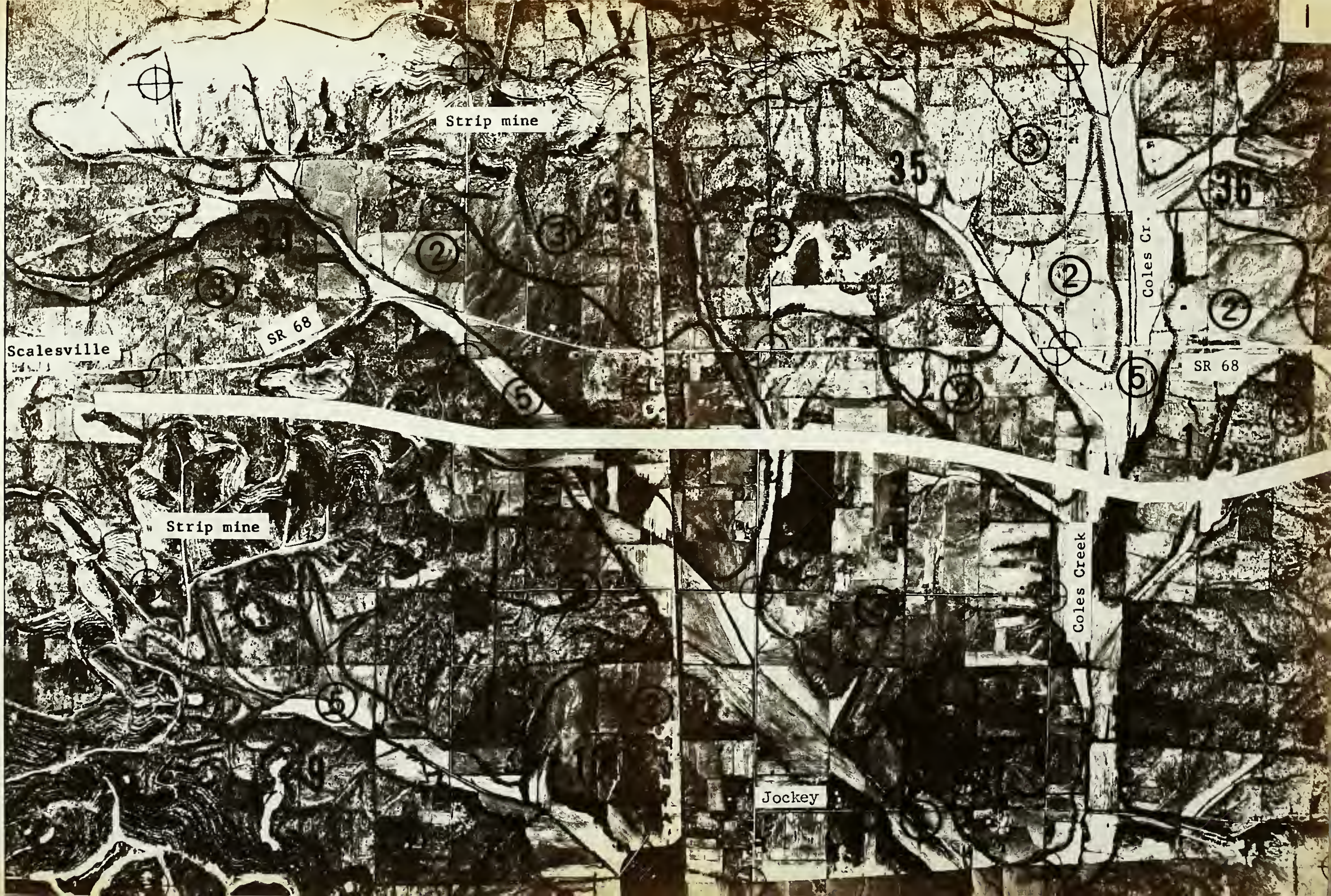
24
36
48
60
72
84
96
108
120

GENERAL SOIL PROFILES

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Strip mine
34
3
2
3
34
35
3
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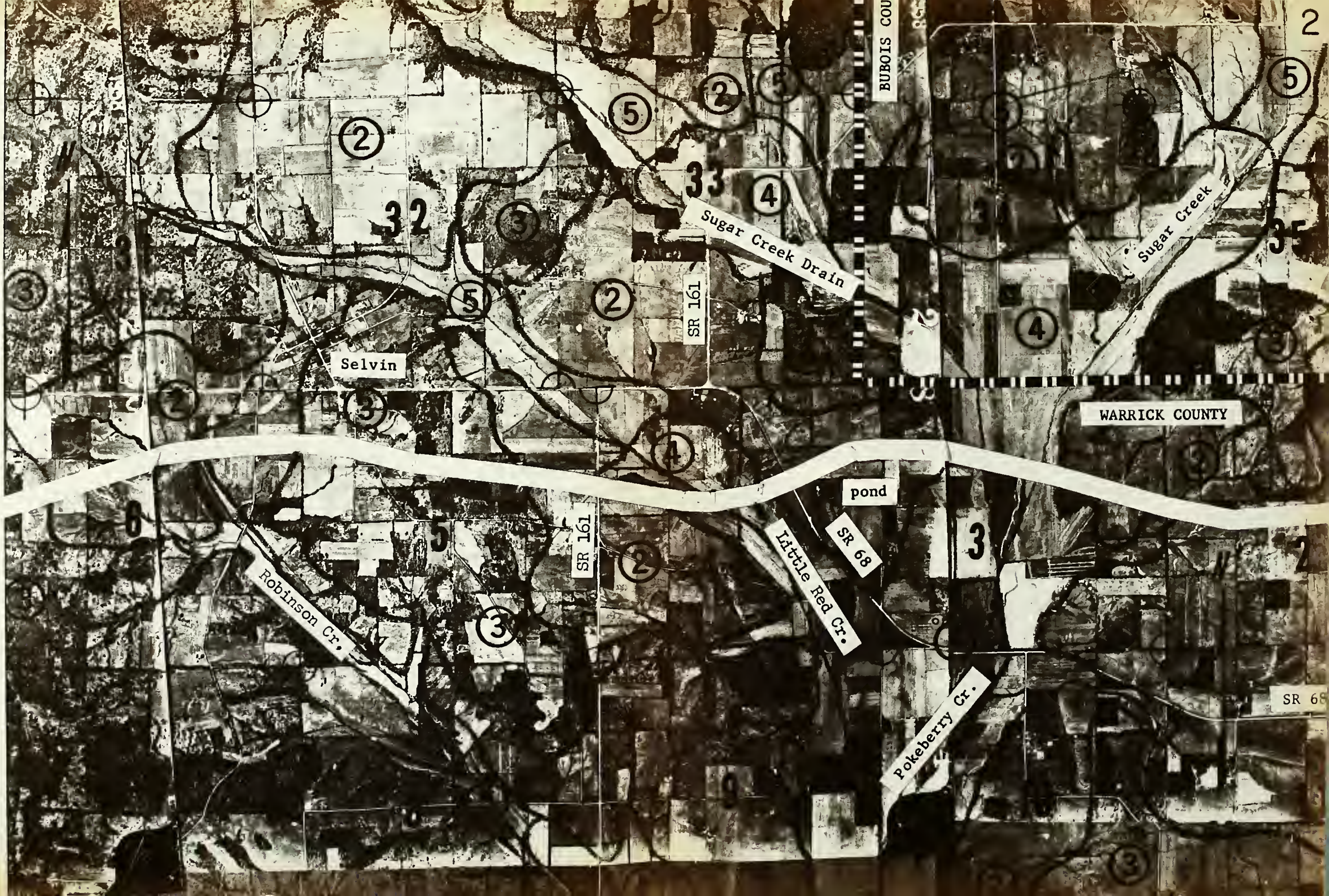
2
Coles Cr.
2
2
SR 68
Scalesville
5
5
SR 68
Strip mine
Coles Creek
6
9
Jockey


BUBOIS COU
②
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⑤
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33
④
32
③
Sugar Creek Drain
Sugar Creek
35
③
⑤
②
SR 161
④
Selvin
②
③
WARRICK COUNTY
④
pond
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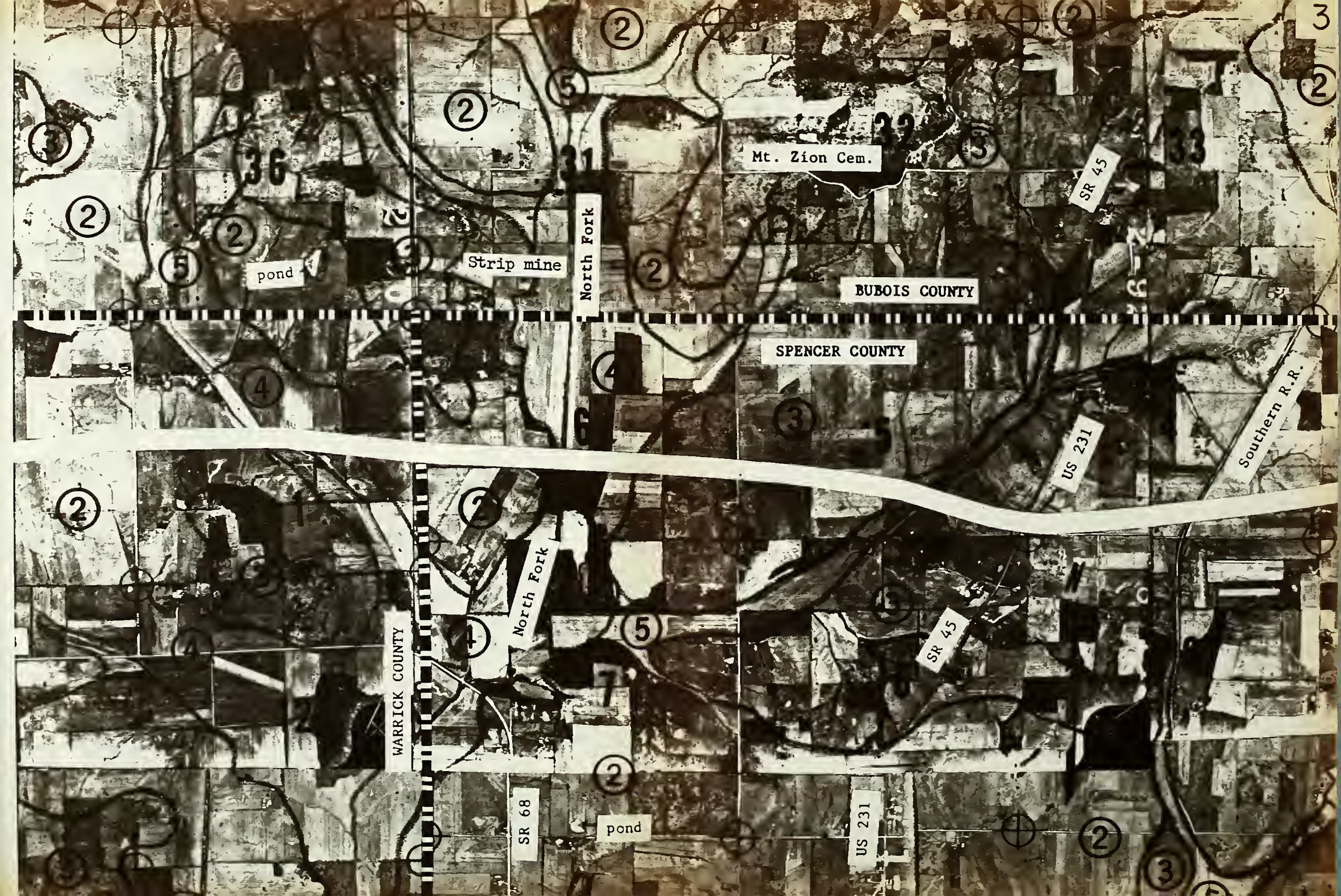
3
2
Robinson Cr.
③
Pokeberry Cr.
SR 68
③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SPENCER COUNTY
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SR 45
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SR 68
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US 231
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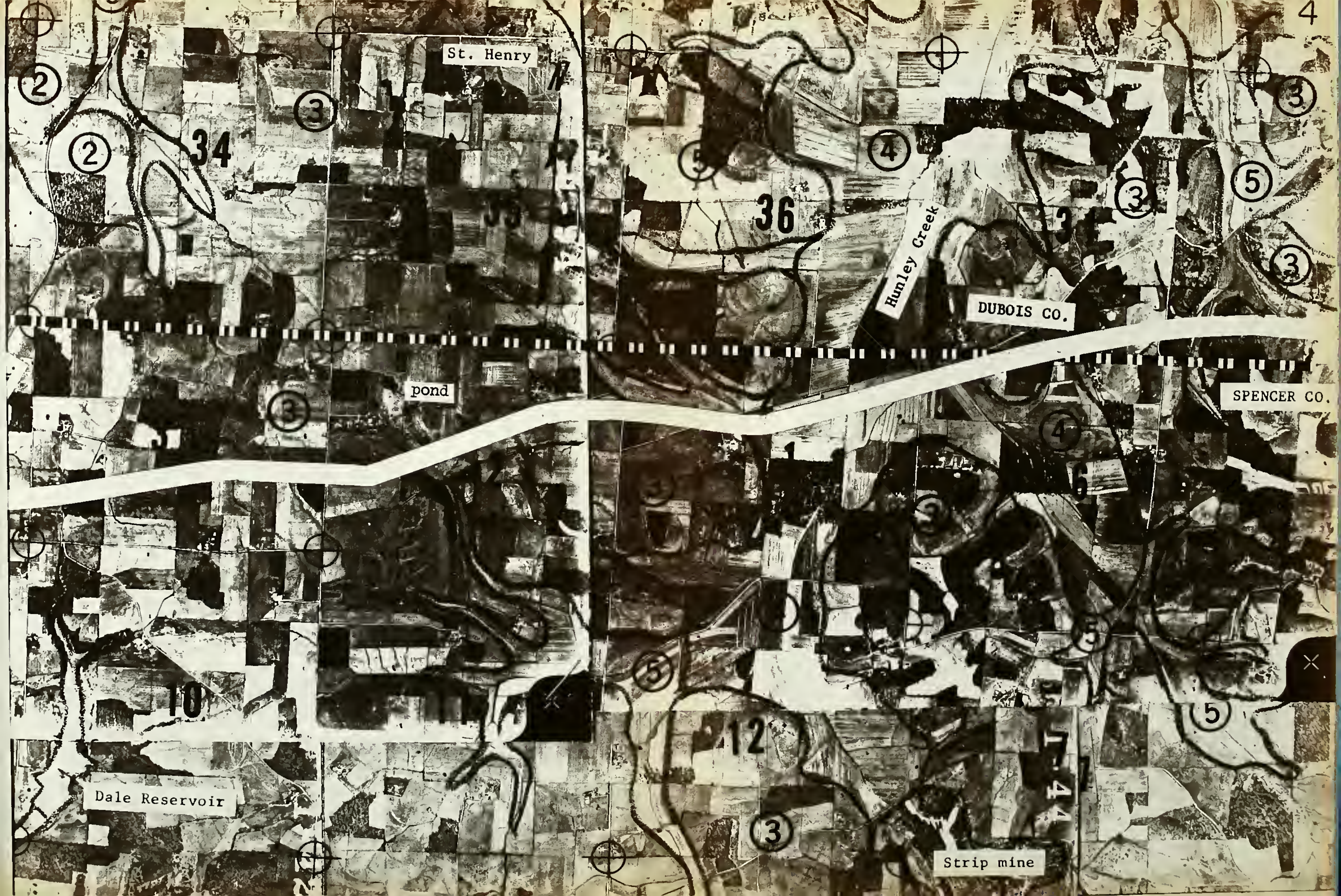
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Hunley Creek
DUBOIS CO.
pond
③
SPENCER CO.
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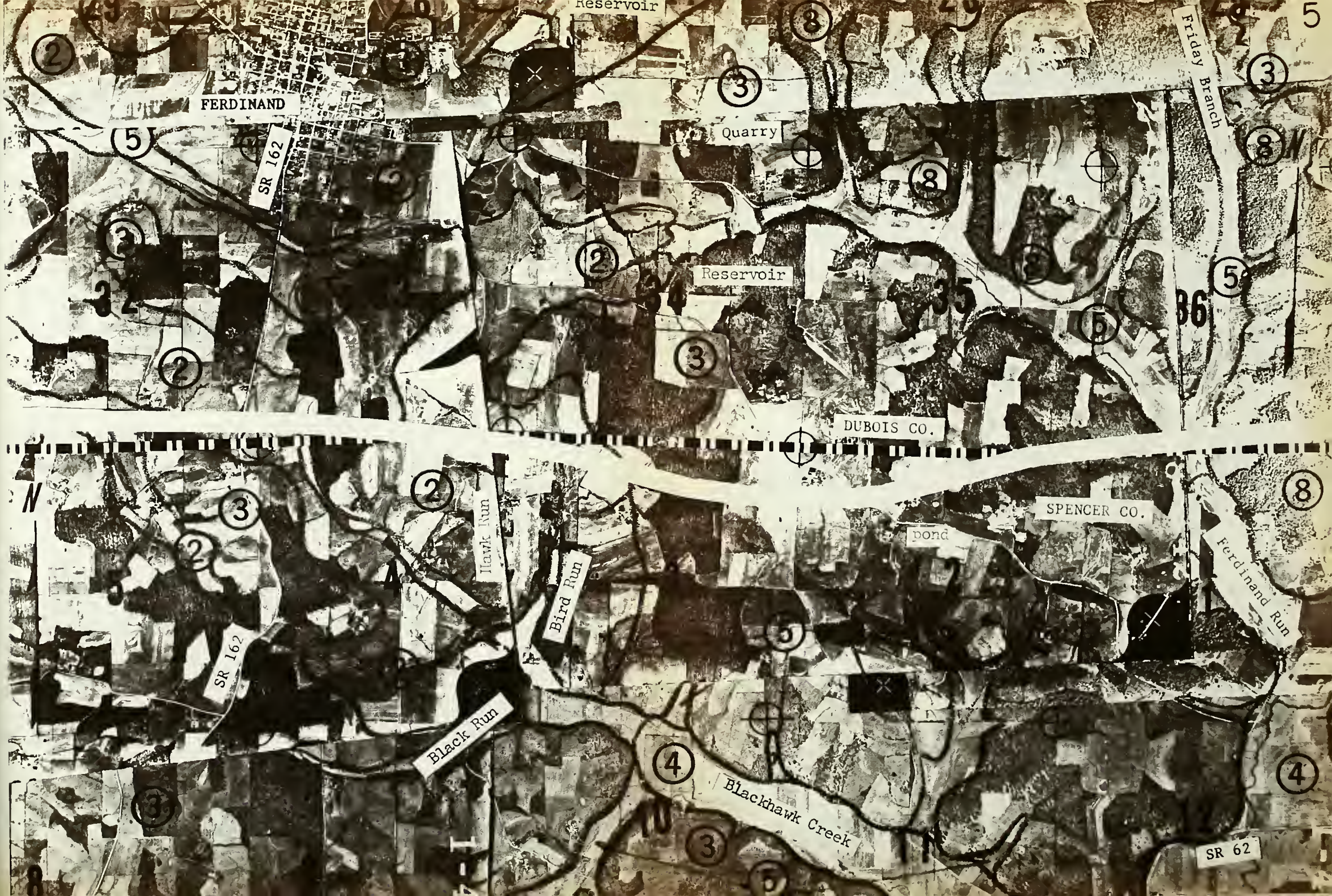
12
Dale Reservoir
③
Strip mine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FERDINAND
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Reservoir
Friday Branch
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35
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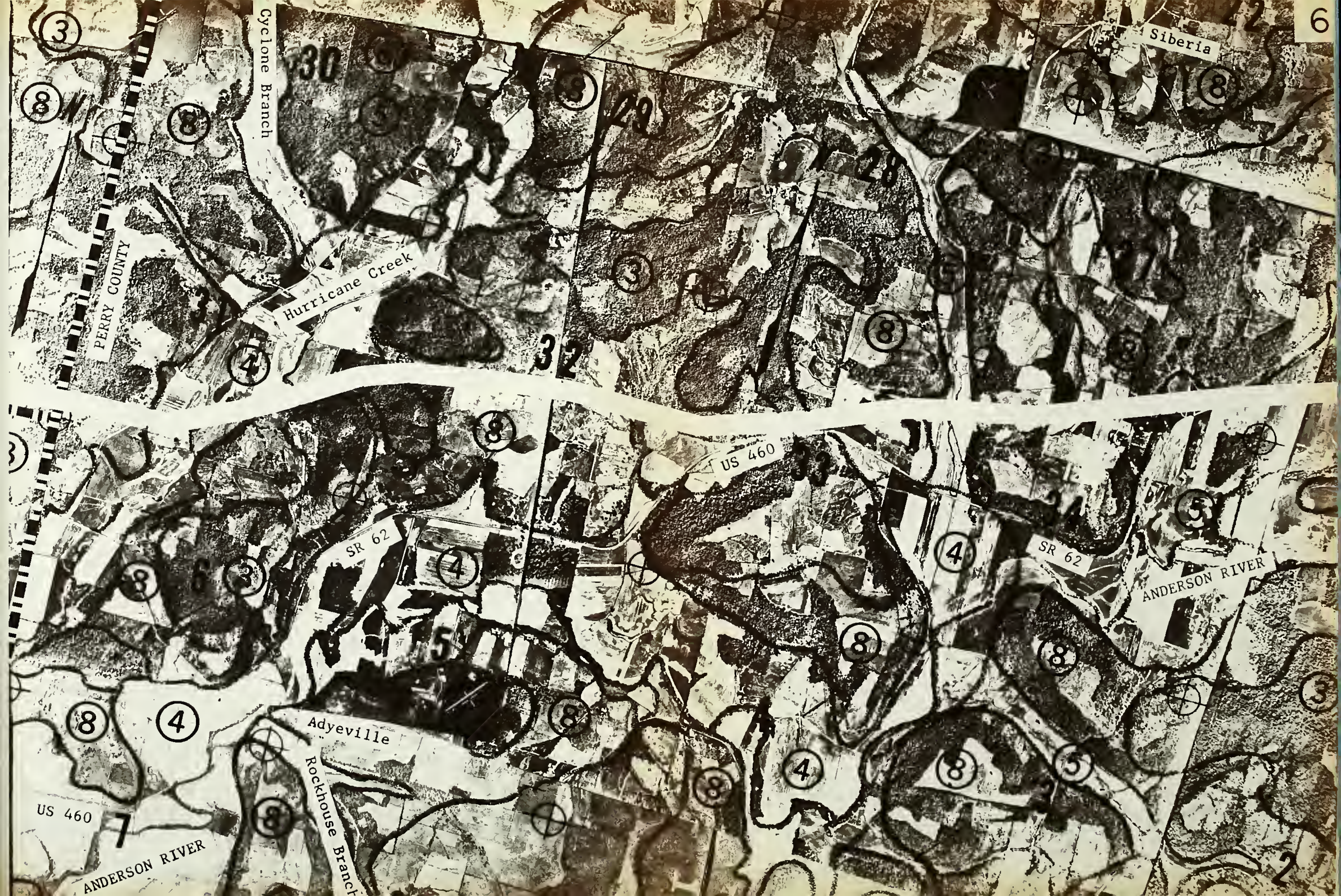
Bird Run
SR 162
Black Run
Blackhawk Creek
Ferdinand Run
SR 62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Cyclone Branch
PERRY COUNTY
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Adyeville
Rockhouse Branch
5
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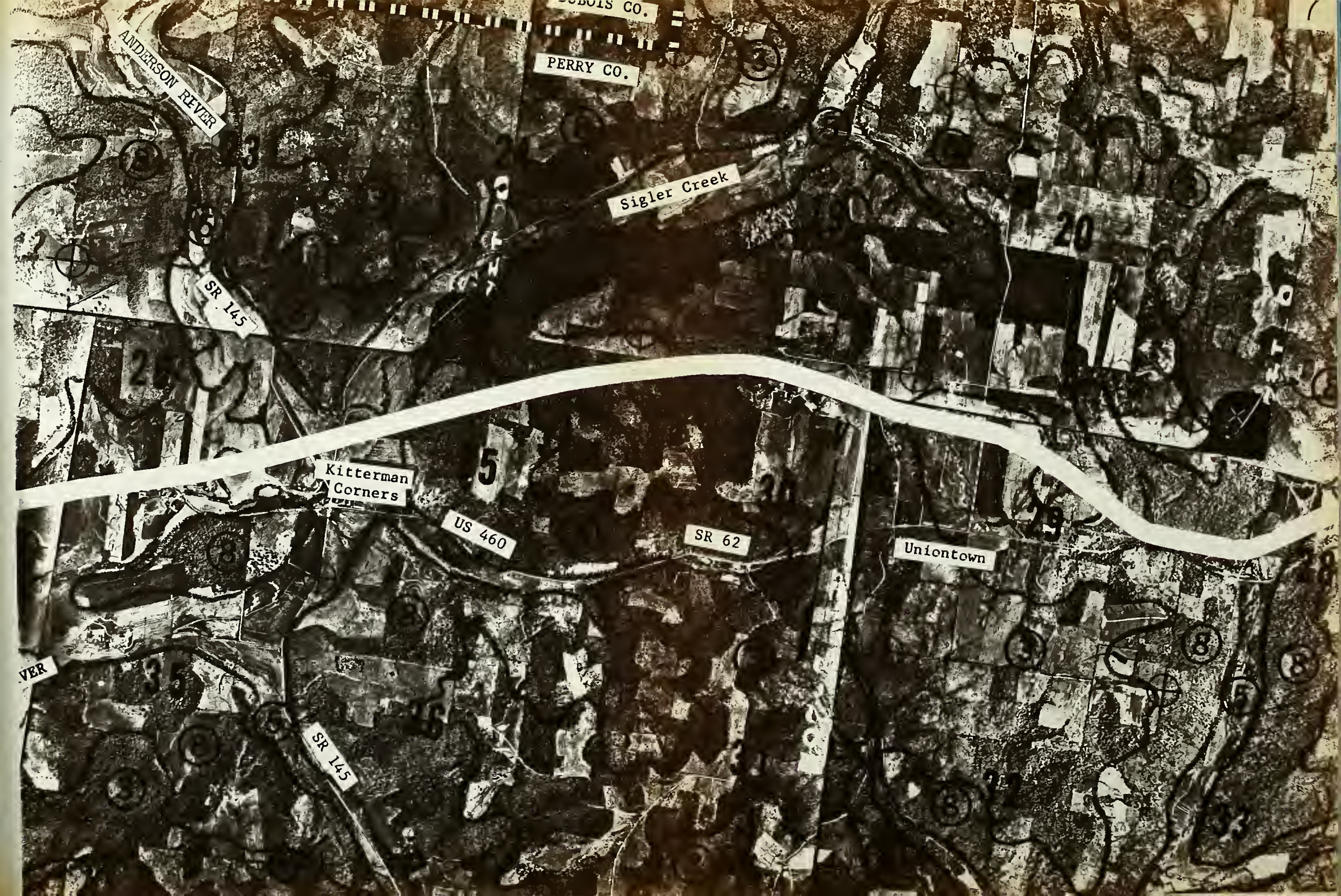
US 460
ANDERSON RIVER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PERRY CO.
ANDERSON RIVER
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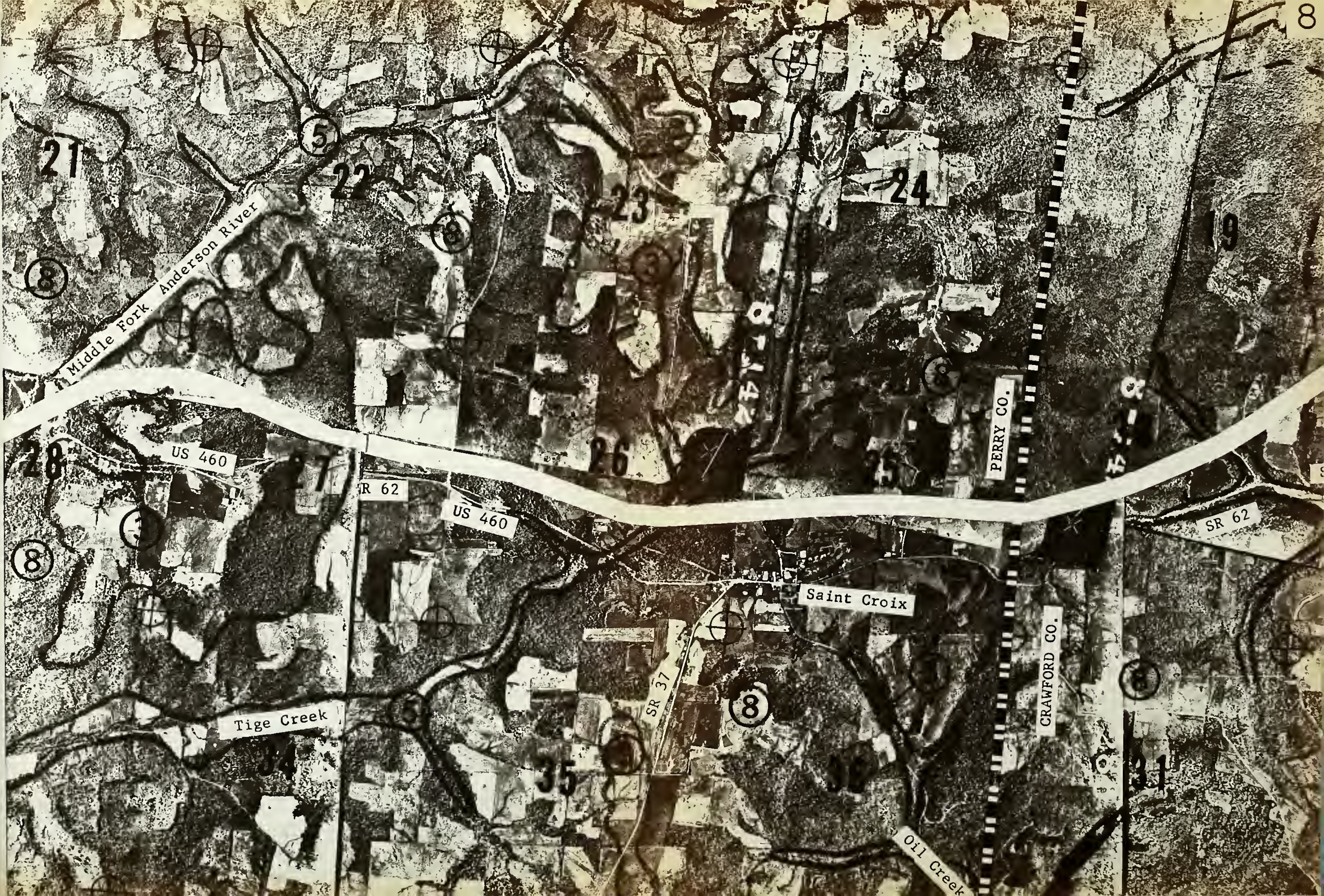
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US 460
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CRAWFORD CO.
SR 37
Tige Creek
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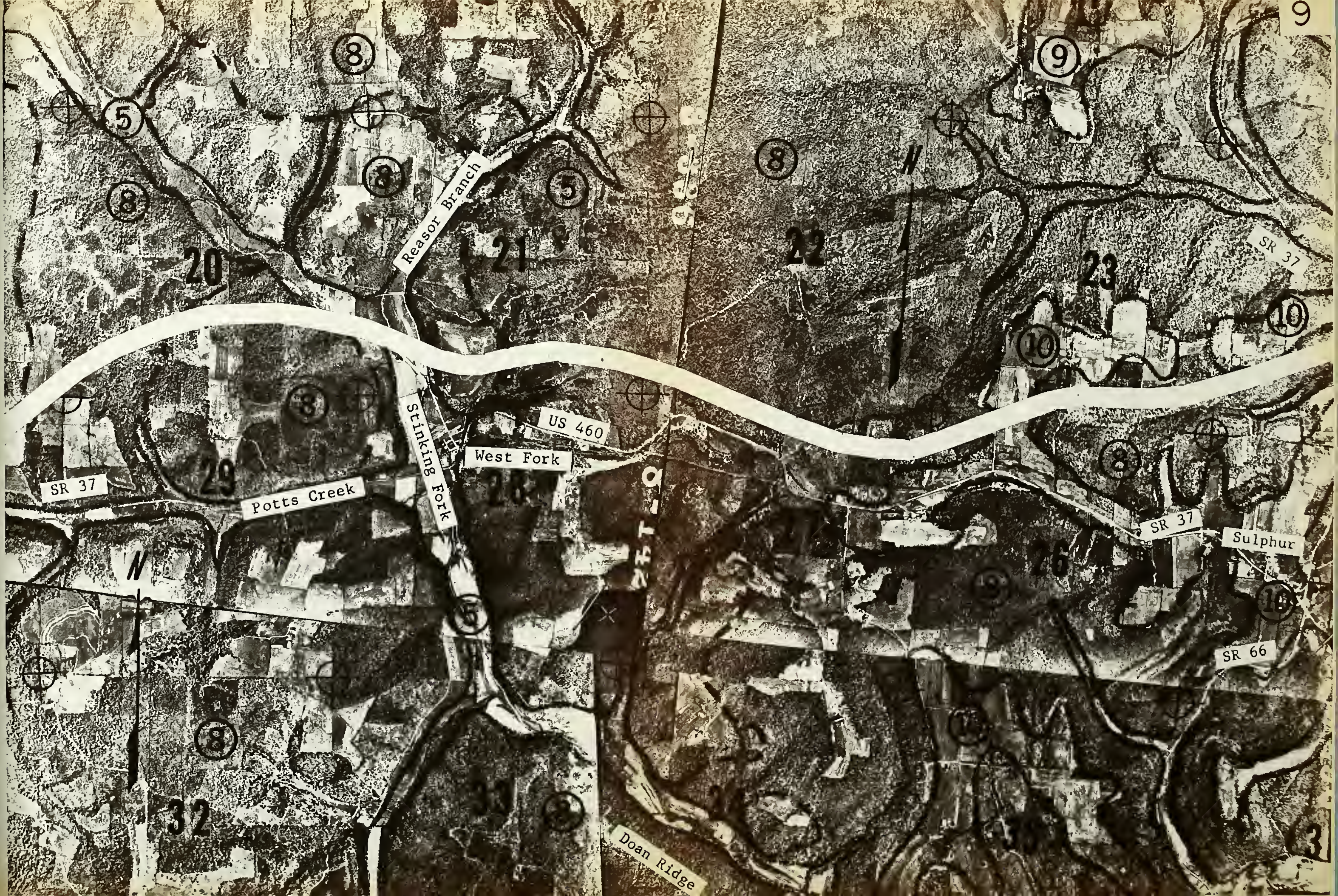
Oil Creek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Potts Creek
SR 37
SR 37
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Sulphur
SR 66
Doan Ridge
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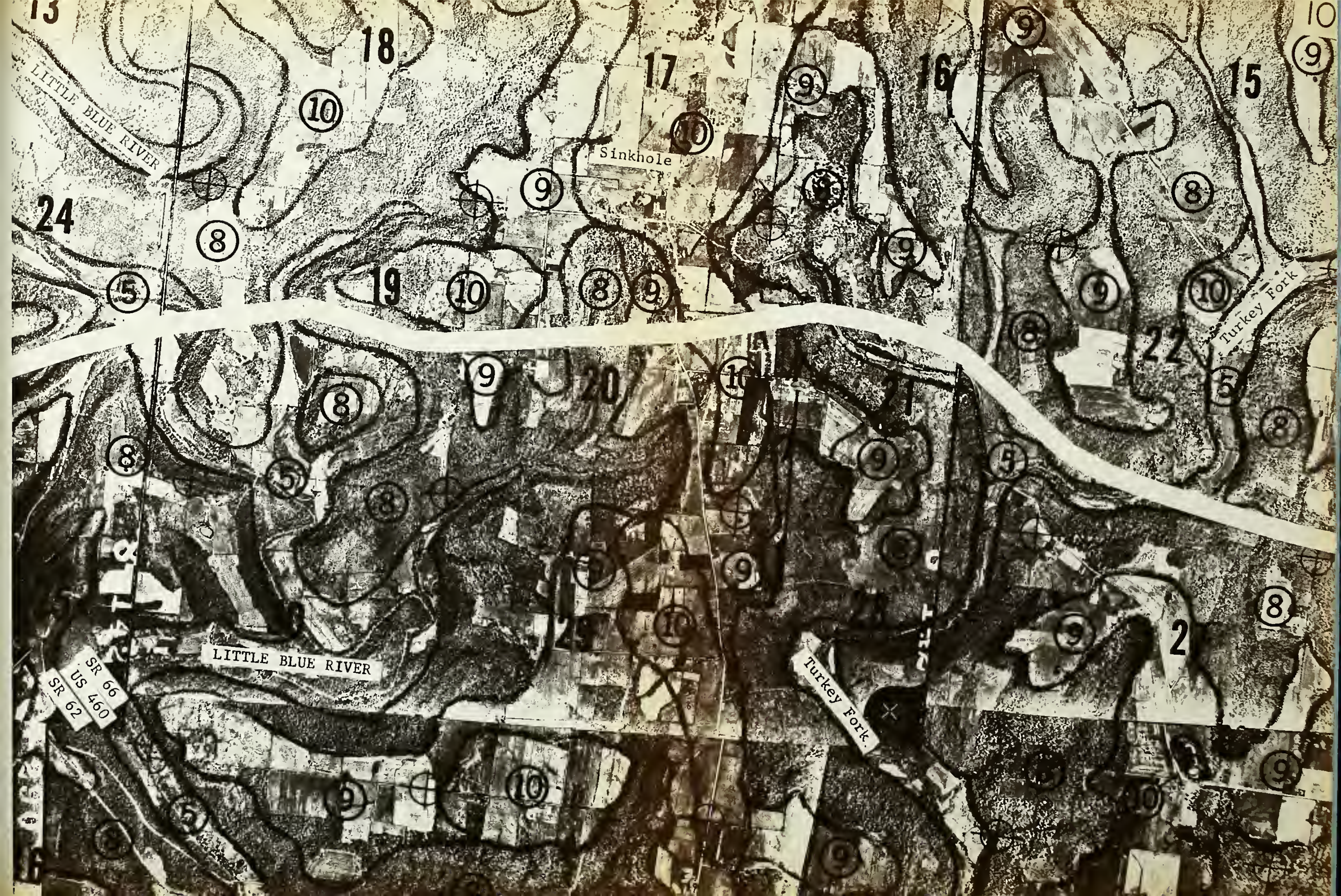
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10
LITTLE BLUE RIVER
Sinkhole
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Turkey Fork
LITTLE BLUE RIVER
Turkey Fork
SR 66
US 460
SR 62
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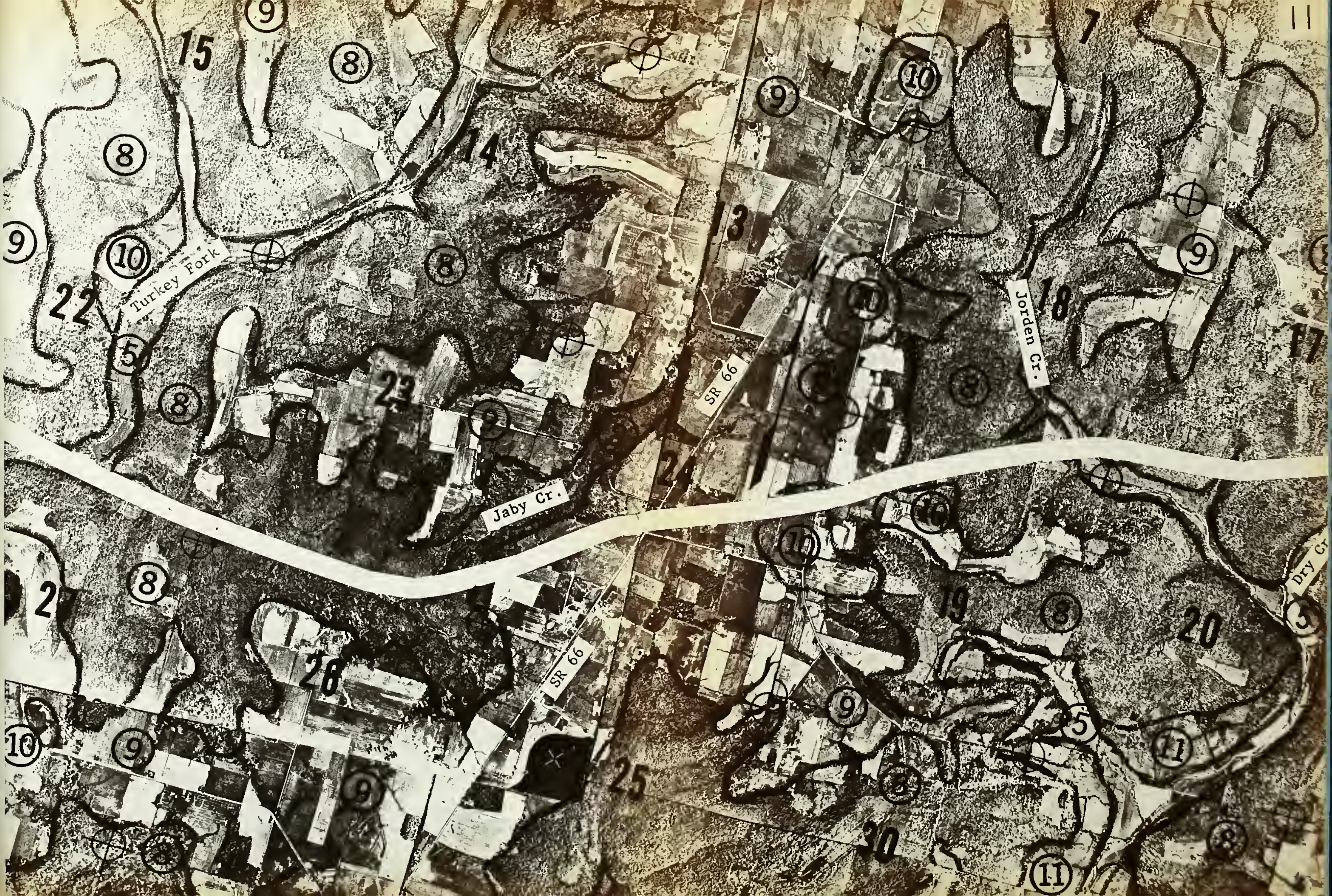
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Turkey Fork
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⑩
Jorden Cr.
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⑧
23
⑨
SR 66
⑧
24
Jaby Cr.
⑩
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27
Dry Cr.
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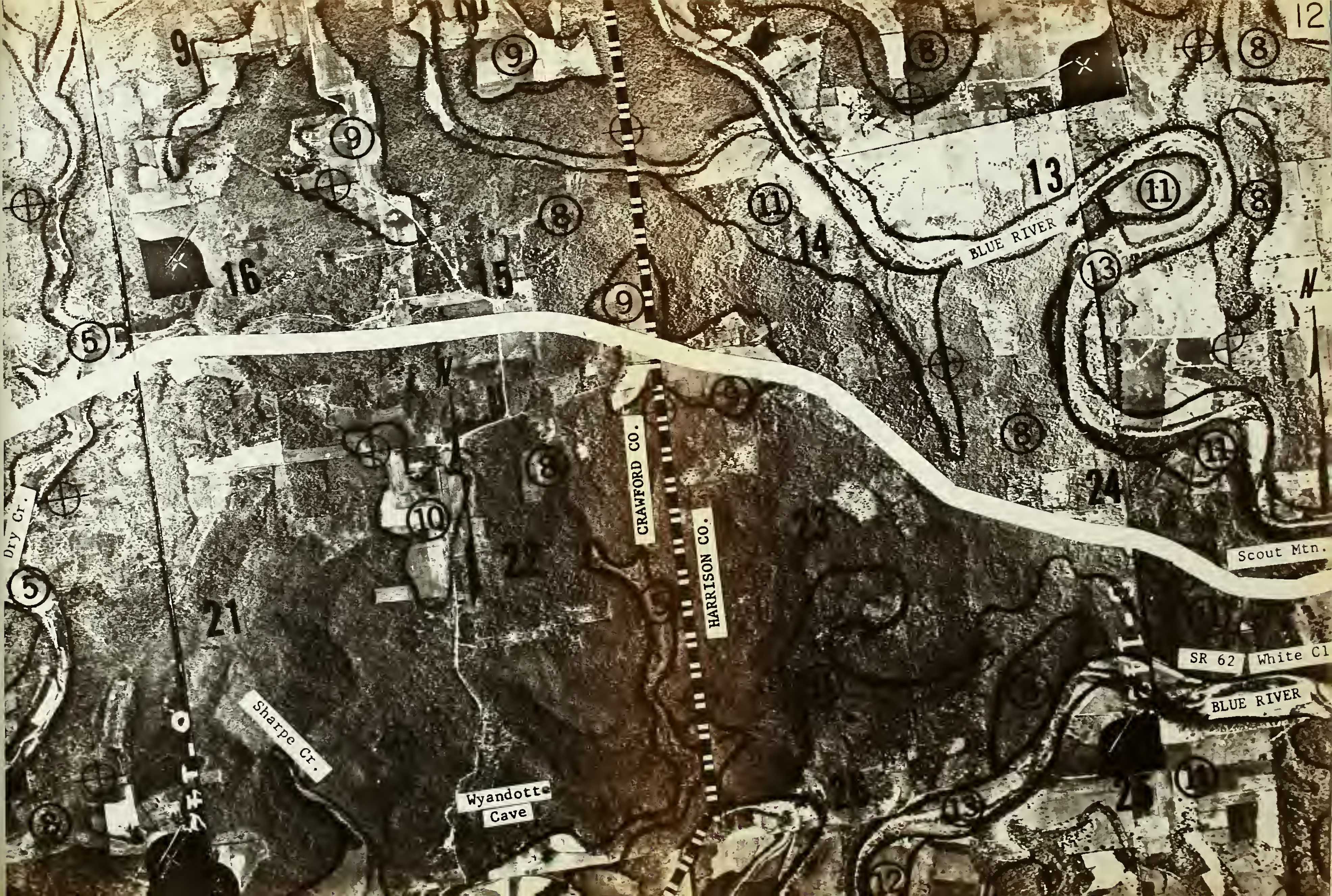
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BLUE RIVER
CRAWFORD CO.
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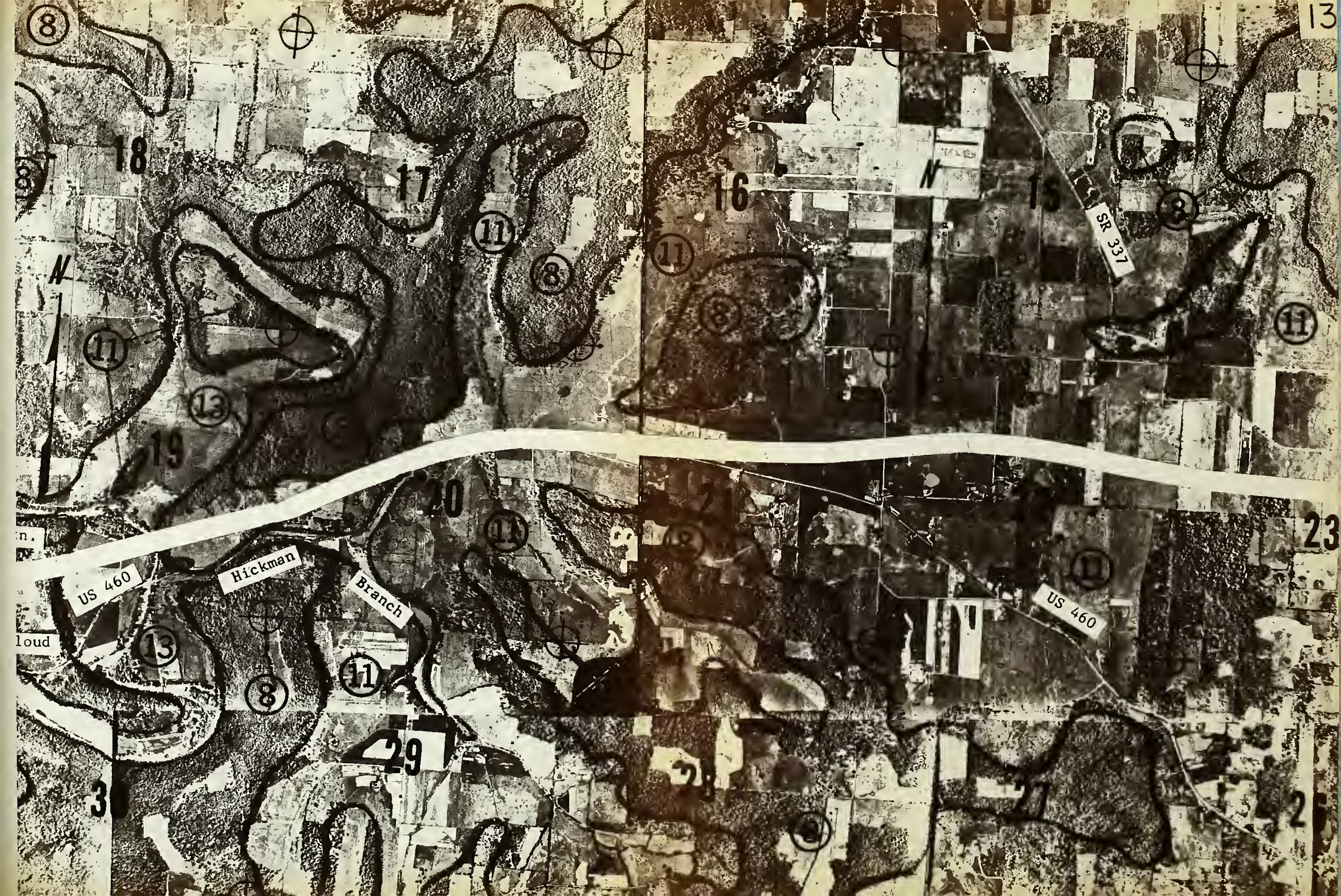
White Cl
BLUE RIVER
Dry Cr.
Sharpe Cr.
Wyandotte
Cave
N
N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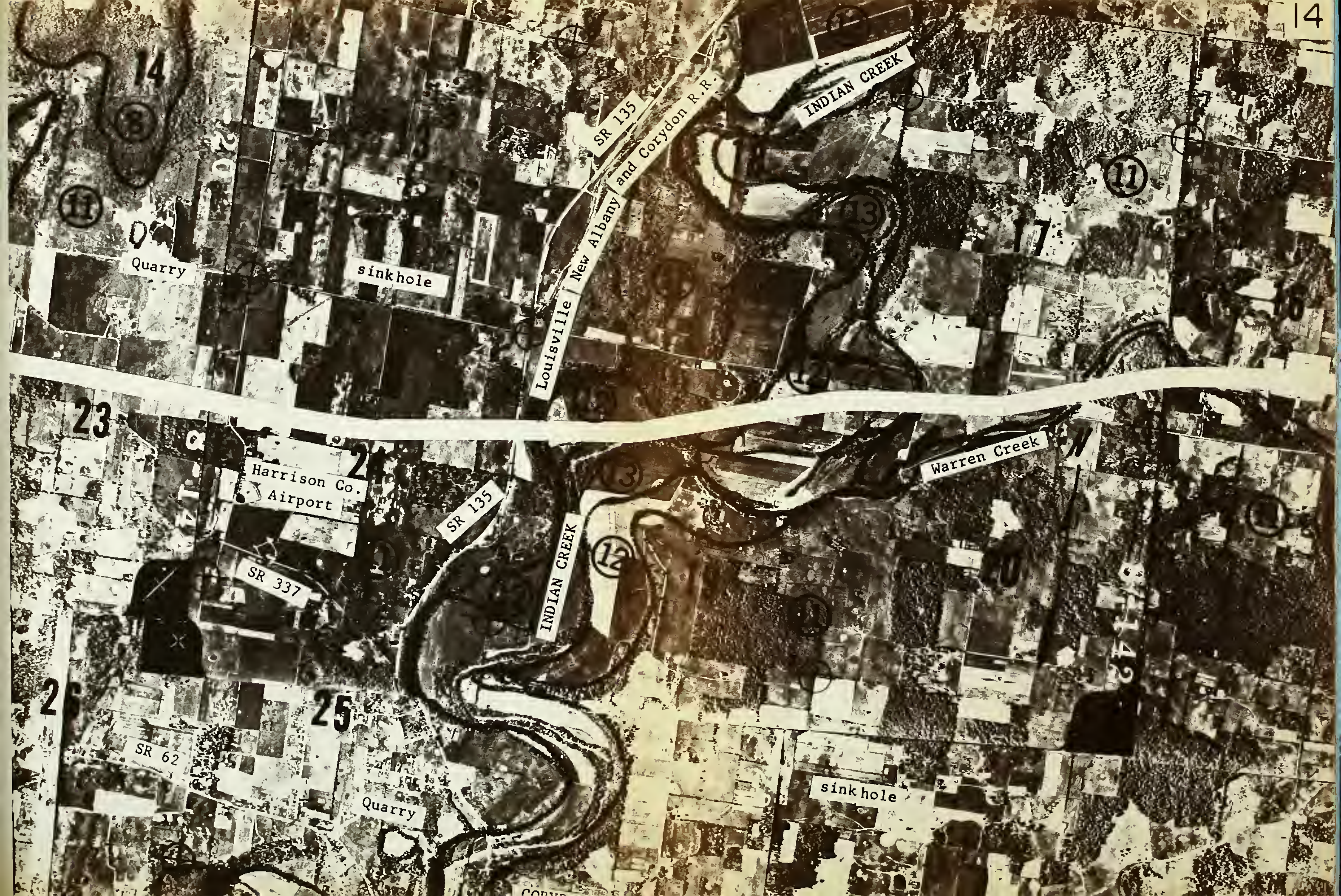
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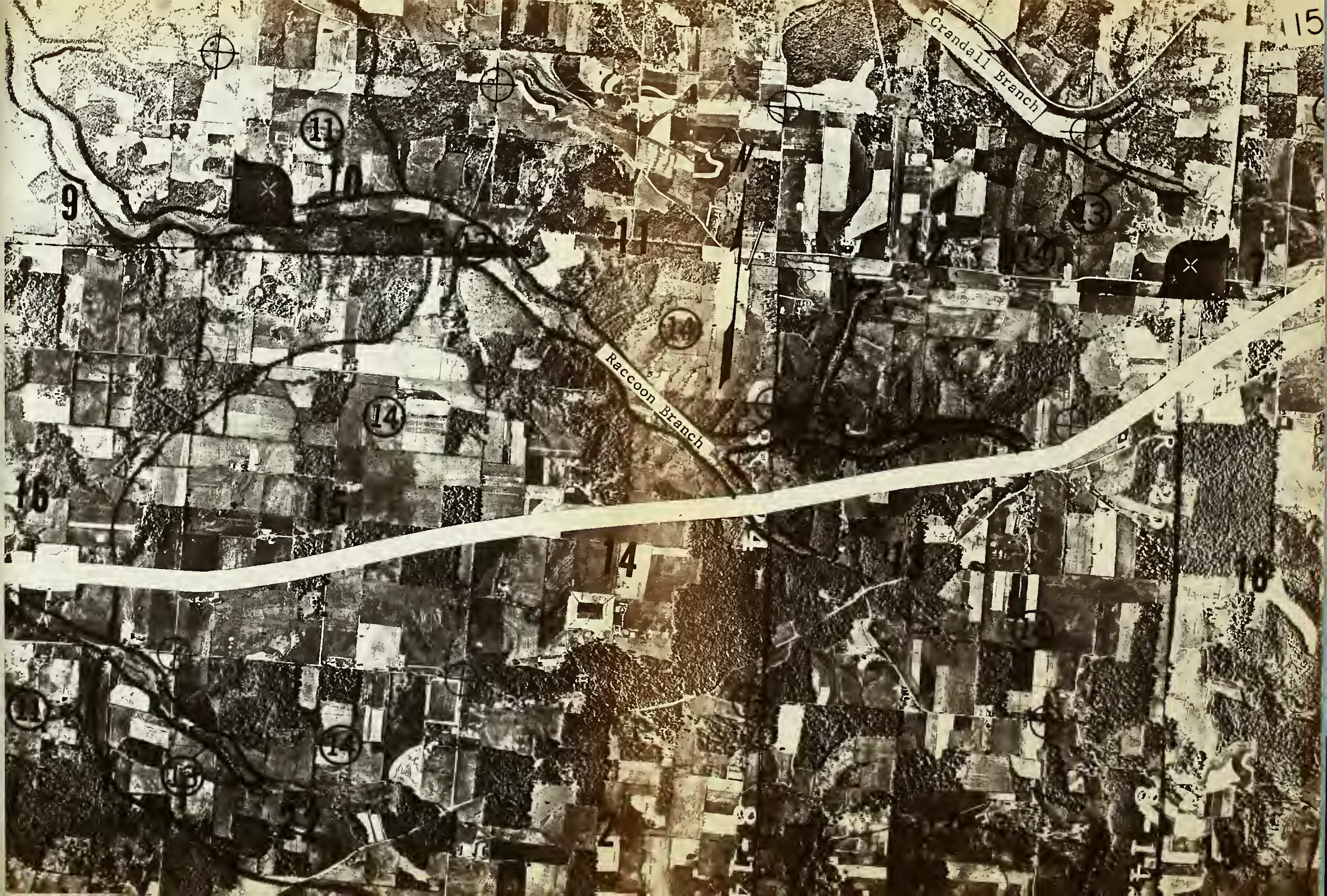
Quarry
sinkhole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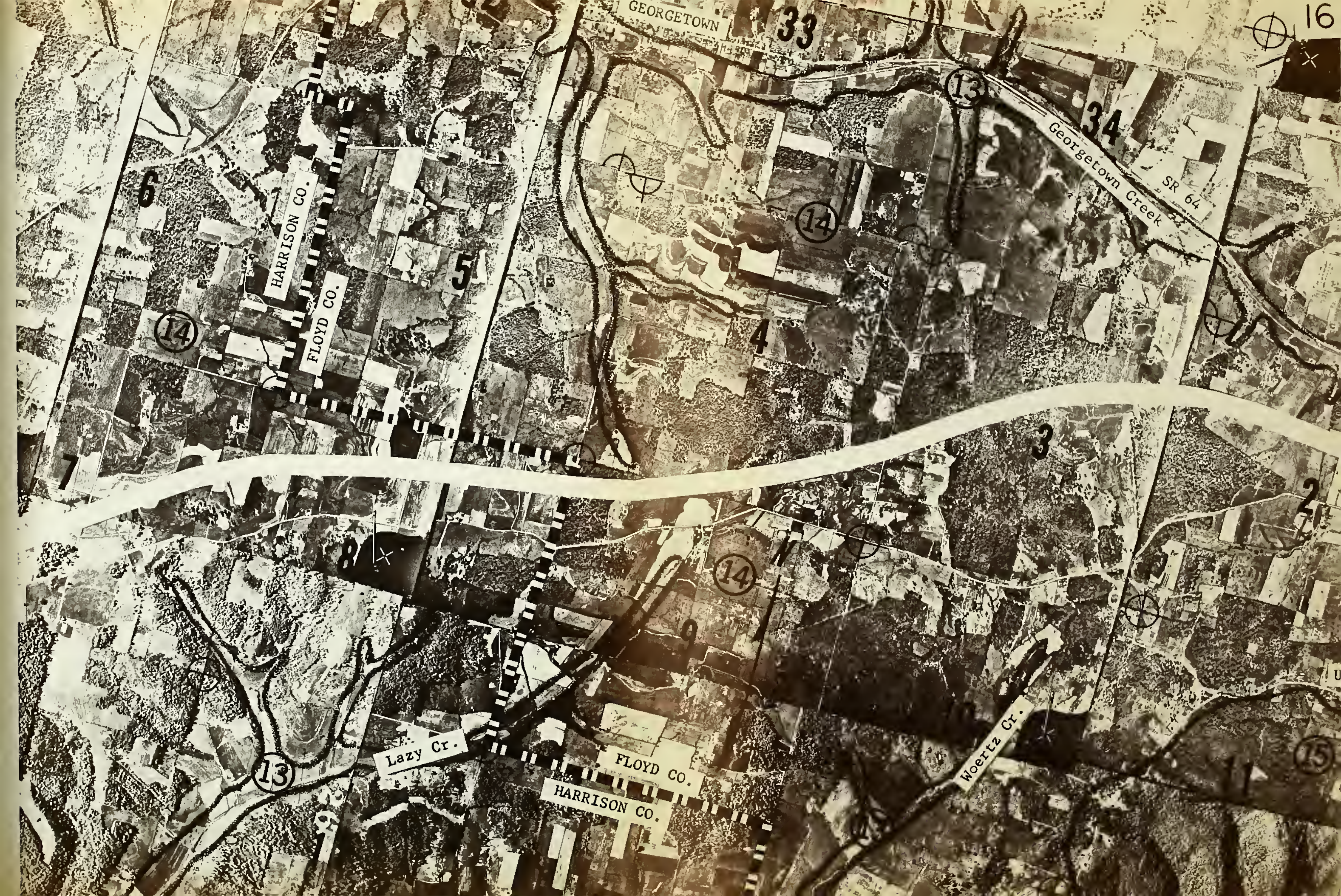
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FLOYD CO.
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FLOYD CO.
HARRISON CO.
Woertz Cr.
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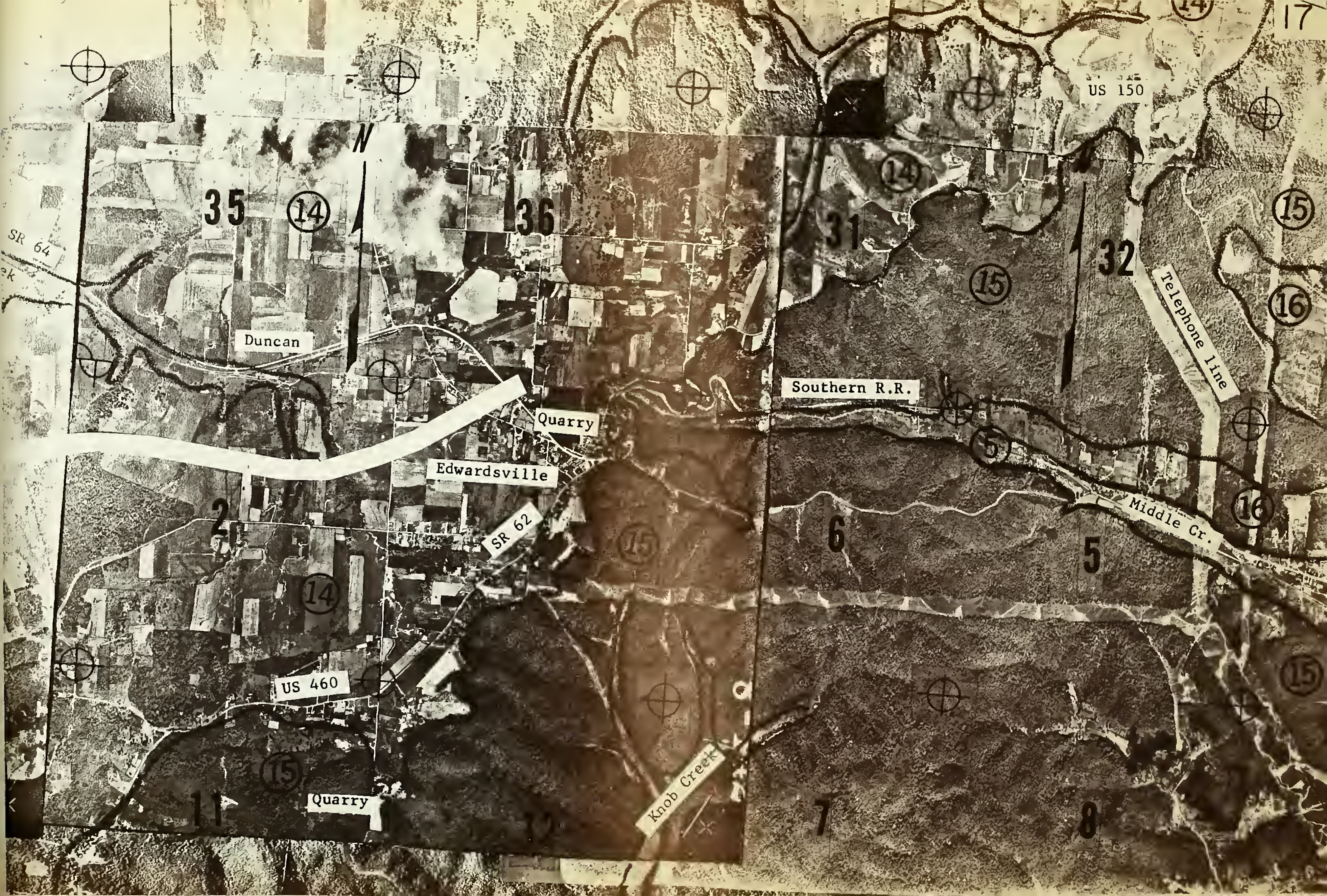
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SR 64
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Telephone line
Duncan
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Quarry
5
Edwardsville
Middle Cr.
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SR 62
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US 460
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Knob Creek
Quarry
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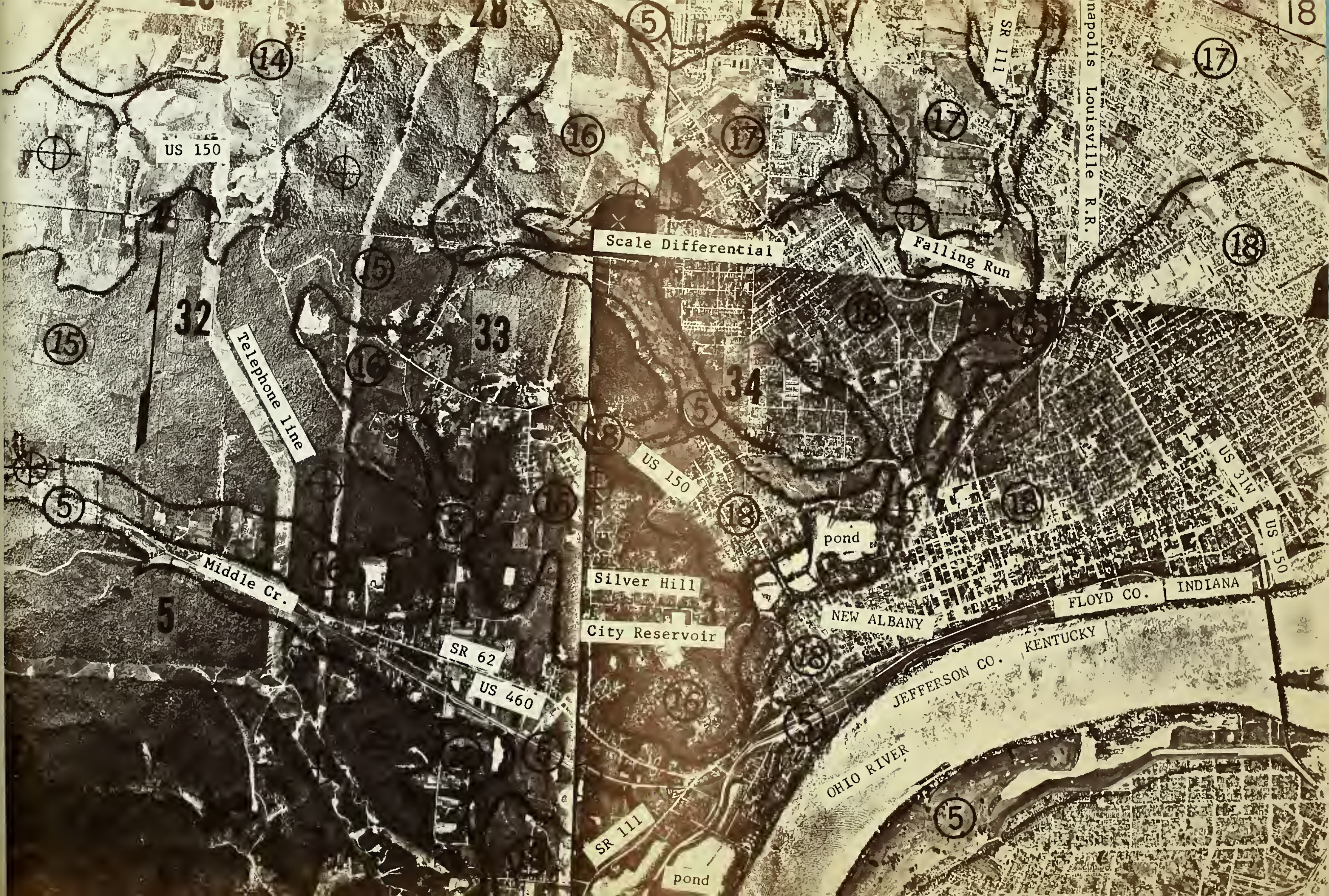
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Scale Differential
Falling Run
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34
Telephone line
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18
US 150
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18
pond
5
16
16
Middle Cr.
5
Silver Hill
City Reservoir
SR 62
US 460
NEW ALBANY
FLOYD CO.
INDIANA
US 31W
US 150
18
16
KENTUCKY
JEFFERSON CO.
OHIO RIVER
5
SR 111
pond